NOVEMBER, 1954

# PIPE LINE INDUSTRY

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CONSTRUCTION • OPERATIONS • MAINTENANCE

## Inventory Ideas

Transco has devised a continuous inventory of items ranging in value from two cents to thousands of dollars. It's kept current on a 30-day basis. It's accuracy has prompted other companies to adopt the idea.

Page 54

## River Crossing

TGT has crossed the Mississippi again. The company's third multi-line crossing of the river consists of three 12-inch lines of 1⅛-inch wall thickness, eliminating the need of weights and special coatings.

Page 60

SERIAL RECORD
DEC 6 - 1954
COPY

*Turn page for additional contents and a Quick Review of this Issue*

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# How to install the new TUBE-TURN Full-Encirclement Saddle for a "Hot Tap"

1. *Weld branch outlet pipe to run pipe according to normal procedure.*
2. *Position and block up bottom half of full-encirclement saddle.*

3. *Slip top half of full-encirclement saddle over branch outlet. Bring two halves together tightly by means of clamp such as shown.*

4. *Tack weld longitudinal lap plates to top half of saddle, remove clamp and complete welding of plates. (Plates are shop-welded to bottom half).*

5. *Fillet weld saddle outlet to branch pipe.* 6. *Join branch pipe to* TUBE-TURN *Welding Neck Flange. Normal tapping procedure follows.*

NOTE THAT when used with high yield strength, thin-wall pipe, as shown above, circumferential welds between saddle ends and run pipe are not required. This precludes possibility of failure due to underbead cracking or to local stress concentrations which exists at such attachment welds with conventional saddles or other types of "hot tap" fittings which must be fillet welded to high yield strength, thin-wall pipe. The TUBE-TURN Full-Encirclement Saddle fully meets all requirements for reinforcement of welded branch connections as developed by Section 8 of the Code for Pressure Piping.

*This new, advanced design is another example of TUBE TURNS' pioneering... why it pays to do business with the leader.*

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PIPE LINE INDUSTRY

# CONTENTS and Quick Review

November, 1954 Vol. 1, No. 5

**To help you put first things first, scan these time-saving digests, checking ☑ those you want to read first.**


**Transco Completes 36-Inch Line**

☐ The first cross-country high-pressure gas pipe line of 36 inches in diameter was scheduled for completion early this month by Transcontinental Gas Pipe Line Corporation, the company that laid the first high-pressure 30-inch line. The construction, engineering and inspection of this line followed the new ASA piping code to the letter. Pipe is .409 wall and weighs 155 pounds per foot. Because of this weight, the contractor decided to use the "sewer pipe" method of laying, welding each joint in a bell hole.

By Donald M. Taylor.....Page 64

**Pipelining High-Viscosity Crudes**

☐ Some Mississippi crudes are more solid than liquid at 60° F. So they have to be heated to be pipelined. Here is the story of the design and operation of Gulf Refining Company's 88-mile-long steam-heated pipe line.

By Morgan Martin.....Page 69

**Evaluating the Performance of Motors for Pipe Line Pumping**

☐ What do you want in an electric motor for a pipe line pump station? How important is starting torque? Reduced voltage starting? What about reduction of air gap to improve power factor? For these answers read the first of a two-part article in this issue.

By E. B. Turner.....Page 78

**50-Mile Jungle Pipe Line Completed in New Guinea**

☐ A new pipe line now courses through the jungles of Netherlands New Guinea. The last six and one-half miles of the line is supported on a special pipe trestle erected above the coastal swamps. For details of construction and pictures of the line see . . .

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**Dehydration of Light Hydrocarbon Liquids**

☐ The second of a three-part article on this vital subject features methods of regeneration such as closed vapor systems, open vapor-inert gas systems, and closed steam systems. Also included is a discussion of actual design factors which should go into the selection of a dehydration unit.

By John M. Campbell.....Page 90

**A New Way to Write a Technical Article**

☐ Turn that technical report into an article that can be sold! It's easier than you might think. Just follow a few simple rules. The next time you have to prepare a report you may end up with extra money in your pocket. An outstanding technical editor tells how.

By Cy Freeman.....Page 98

**What Happens When a Tornado Hits a Pump Station**

☐ Here's a vivid account of the damages sustained at Service Pipe Line Company's Payson station and the quick work done to get everything in order again.

Page 103

**Electronics Can Save Money in Crude Oil Accounting**

☐ Crude oil accounting procedure has been streamlined and valuable time is being saved by use of electronic computing equipment. Recent developments in electronic data processing machine design make this possible. This new technique practically eliminates the human error factor and speeds accounting work.

By J. E. Peck.....Page 105

Who's Meeting Where ..... 53
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## NEXT MONTH

- **The noises in compressor station engine rooms can have a damaging effect on the efficiency of the operators. An article next month will tell how Texas-Illinois Gas Pipe Line Company overcame this problem.**
- **Coming up is another phase of how portable pumps were converted to highly efficient main line stations.**
- **And we'll take you 45 miles from the nearest paved road to El Paso Natural's automatically-operated compressor station in rugged New Mexico country.**

PIPE LINE INDUSTRY published every month. Entered as second class mail matter July 9, 1954, at the post office at Houston, Texas, under the act of March 3, 1879.

# Must Fight Gas Controls Vigorously

**It is vitally important** that Congress amend the Natural Gas Act so it will clearly and unequivocally exempt United States natural gas producers from price regulation by the Federal Power Commission. Remedial legislation by Congress is the only recourse open, the U. S. Supreme Court having held in the so-called Phillips gas case that all natural gas entering interstate commerce is subject to FPC price regulation at the wellhead.

There is widespread agreement in the oil and gas business that remedial legislation is a must. But this universal feeling gives no assurance that Congress will act accordingly.

Neither does the fact that Congress on two previous occasions passed such an amendment, only to have them vetoed by President Truman, give any assurance the present Congress will take similar action. There are many new faces in Congress. Furthermore, the recent Supreme Court decision will make it more difficult to get Congressional approval.

●

**The only sure way** of being certain that Congress will take the right step is to obtain widespread public support for such an amendment. The question must be decided by the good judgment of the citizens as a whole. Therefore, it is time that the people of this country are told the realities of the gas situation. This cannot be accomplished by silence or innocuous stilted statements. A vigorous effort will need to be made to acquaint the consuming public with the true facts and the importance of the question.

The oil and gas industry must spearhead this public information drive. The whole industry must rally behind this program, executives, independent operators, contractors, and investors alike.

A good start in this direction was made during Oil Progress Week, when many industry speakers took advantage of the opportunity to discuss the matter. This was a commendable start, but it is not enough. To this start must be added a continued program of informing the public on a larger scale.

●

**The consequences** of government regulation of natural gas prices at the wellhead are tremendously significant.

The first result will be federal regulation of oil and gas production on a public utility basis. In an effort to escape federal regulation, producers will withdraw large quantities of gas from interstate commerce. Natural gas exploration and development will diminish. These actions can result only in dwindling U. S. natural gas supplies. (See Page 120.) In the long run, scarcer supplies will result in higher consumer prices.

Professors, commentators and politicians have led the public to believe federal regulation will give consumers lower gas prices. To the contrary, higher prices will result. And after all, natural gas is but a very small part of the consumer's bill. Wisconsin has led the battle for federal control of gas prices. Therefore, it is interesting to note that in 1952 Milwaukee and southeast Wisconsin residential users respectively paid $1.21 and $1.44 per thousand cubic feet for natural gas, although Phillips Petroleum Company was receiving a gross field price of less than 9 cents per thousand cubic feet. The difference was due to the cost of transporting and distributing the gas, which already is regulated by the FPC. Wisconsin consumers will find they cannot benefit by reducing field prices, which amount to less than 10 percent of what they pay for gas.

●

**The consequences** will go far beyond the oil and gas industry. A serious question of principle also is deeply involved.

If gas is to be subjected to regulation because of its use by a regulated utility, how can oil and coal escape? They compete with gas for the same energy and heating markets. In many instances, they are used in the generation of electricity, a utility which also is regulated.

If the American people accept these developments, they will be abandoning the American economic and governmental system which is based on freedom of enterprise and a minimum of government regulation —the very basis for the American way of life.

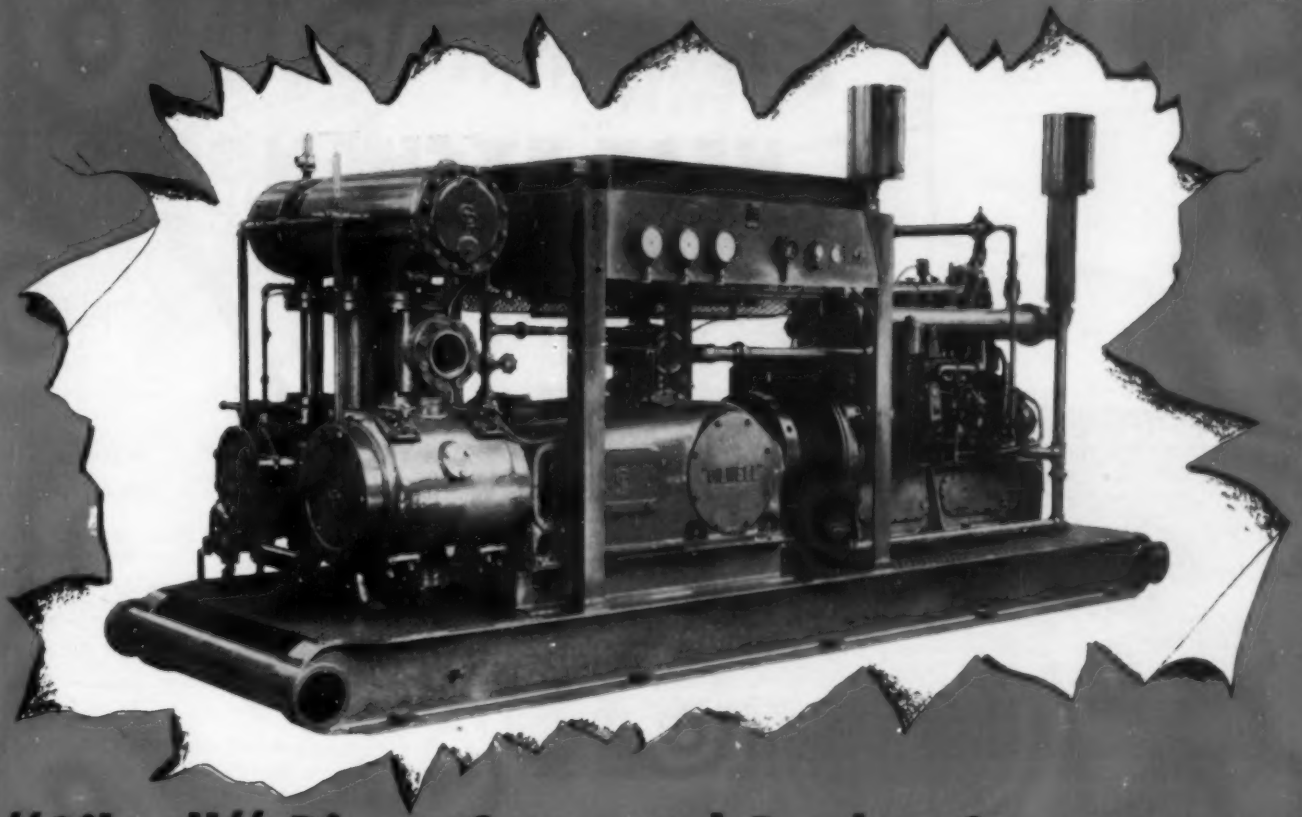
●

**This is an opportunity** and also an obligation for the oil and gas industry to give the facts and consequences to the American people. Every one connected with the oil and gas business should take a vigorous part in the program of enlightening the American people.

Then, when Congress is asked to undo the Supreme Court's decision the public will know the true facts, and can be depended upon to act accordingly.

Warren L. Baker

# NEW and BIGGER



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THESE new Units are designed with direct drive through right-angle gears to two parallel compressors and utilize the horsepower input from a single internal combustion engine with maximum efficiency.

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With the elimination of all V-belts in the design, installations in hazardous locations can be made with maximum safety and minimum installation expense.

***Let your "Oilwell" Representative . . . quote on the "Oilwell" Compressor Unit which will meet your gas-gathering requirements most economically—throughout the 20 to 300 HP range.***

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TRADE MARK

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*Extended-Surface*

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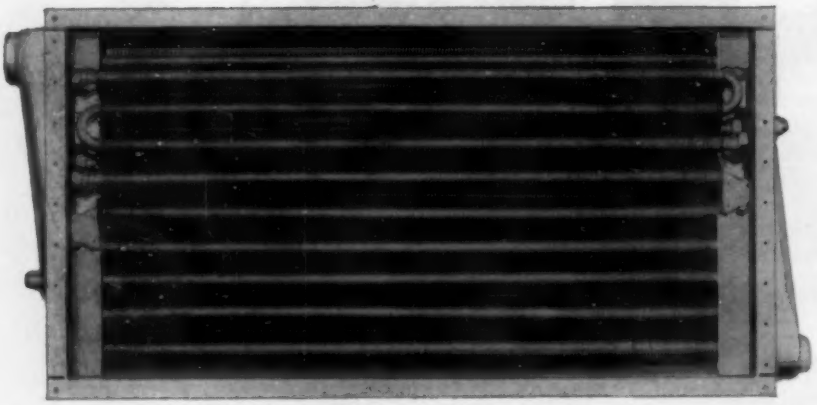
*Exclusively*



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**PIPE LINE INDUSTRY** for the oil and gas pipe line industry.

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**PETROLEUM REFINER** and **THE REFINERY CATALOG** for the refining-natural gasoline-petrochemical industry.

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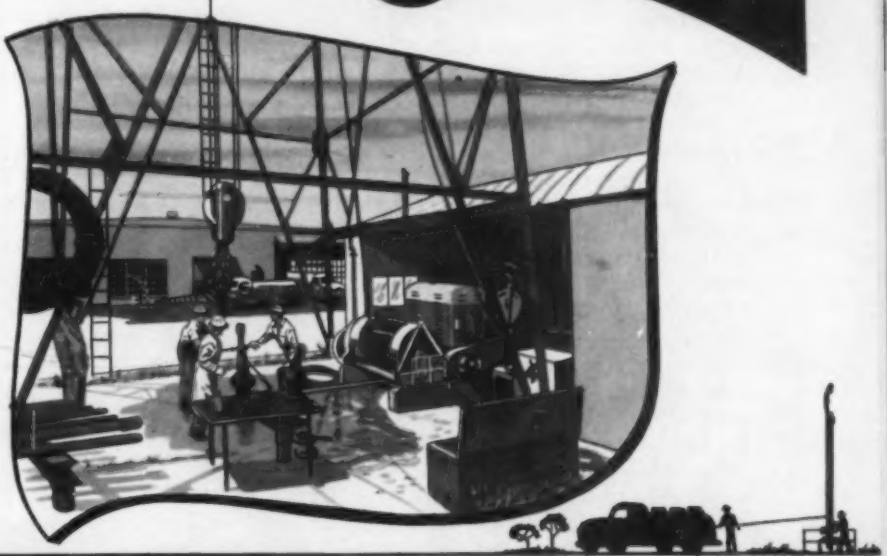
OTIS PRESSURE CONTROL SERVICE · EQUIPMENT

when is the best not good enough?



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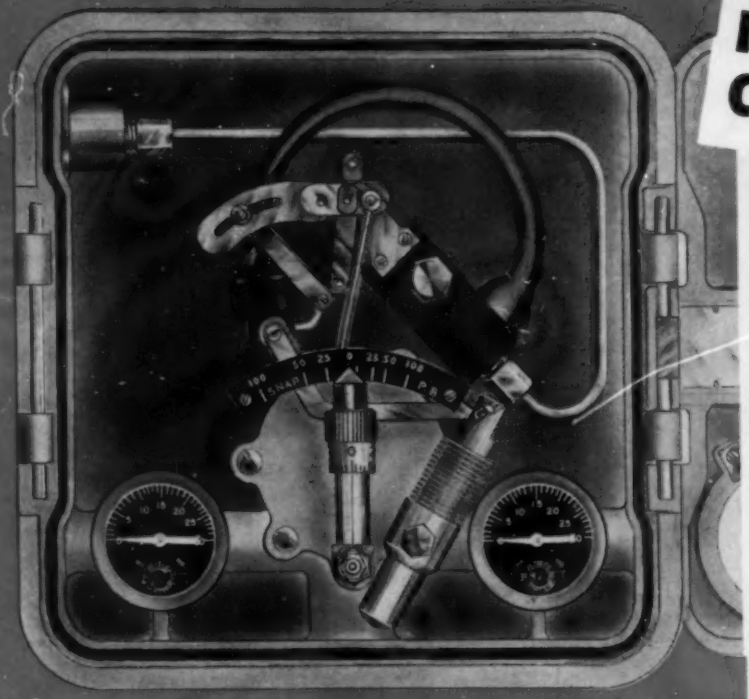

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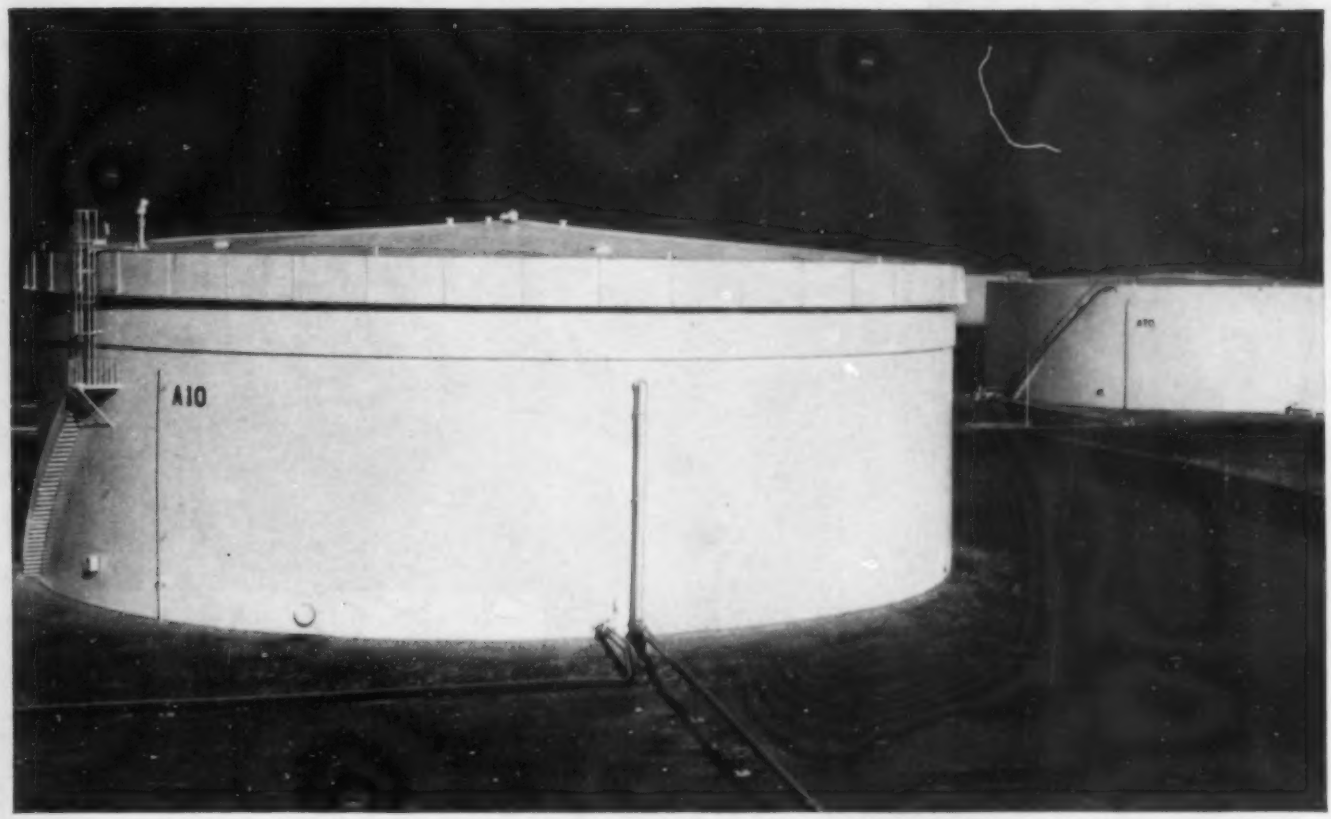


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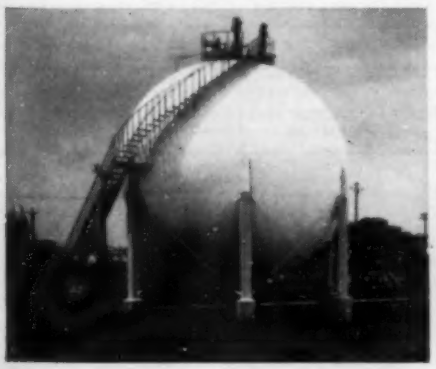

GRAVERSPHERES are especially suitable for storage of natural gasolines and other volatile liquids such as butane. They are the ideal answer to gas storage—sustaining pressures up to and exceeding 100 psi.

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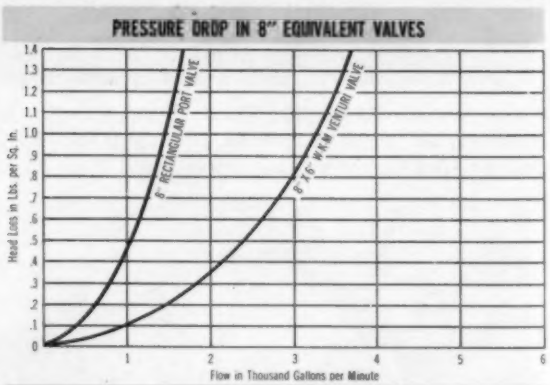
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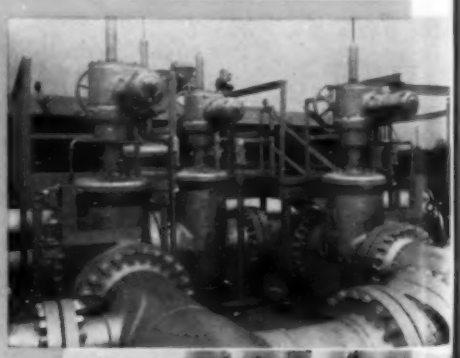

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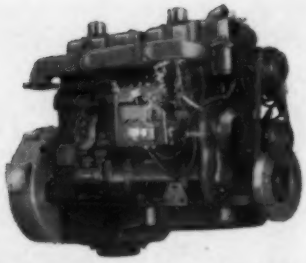

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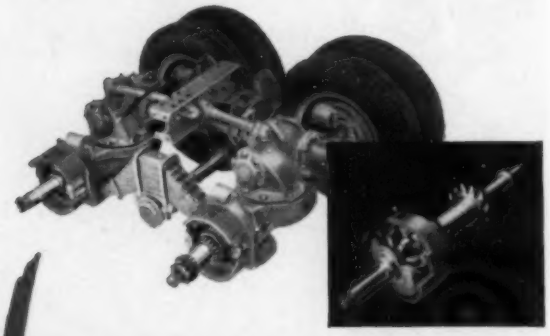

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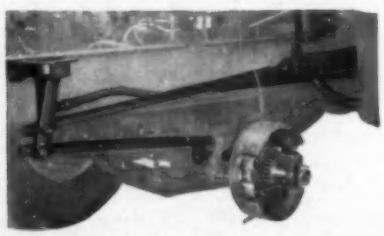

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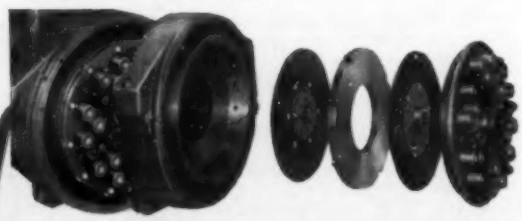

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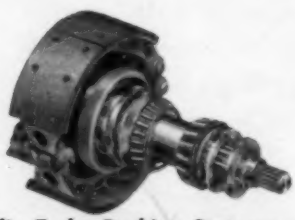

***Hydraulic Turbo-Braking Systems*** and powerful air-actuated brakes provide utmost safety for downhill going, assure safe and positive driver control at all times.

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An oil-soluble organic inhibitor especially designed to prevent corrosion and rust formation in products lines, tankers, pipe lines and other facilities for handling petroleum and finished petroleum products.

Kontol 77 effectively prevents rusting caused by the presence of oxygen in finished petroleum products. It has no harmful effect on product quality. It does not affect color, octane number, accelerated gum, precipitated lead or other av-gas specifications.

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*Chemicals and Services for the Petroleum Industry*

DEHYDRATING • DESALTING • CORROSION INHIBITING • SCALE PREVENTING • PARAFFIN REMOVING • WATER DE-OILING

KPL 54-16

# NEW THE INTERNAL *Tilting Disc* Check for pipeline

**1.** Eliminates the use of bolted gasket joint

**2.** Greatly reduces the cost of valve and installation

**3.** Retains the low head loss of Chapman Tilting Disc Construction

**4.** Weighs far less . . . therefore requires less support

Phantom illustration of Chapman's New Internal Type Check Valve showing how tilting disc valve mechanism is completely enclosed within pipe.

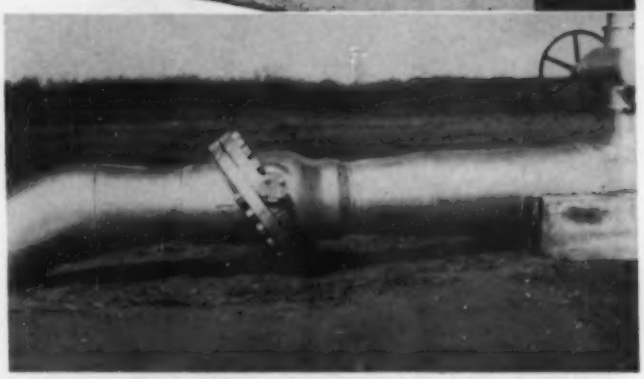
U. S. PATENT NO. 2669419

# TYPE CHAPMAN Valve use

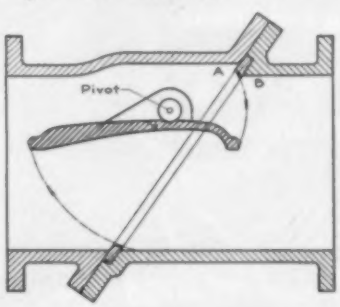
At this point in natural gas transmission line, a 24″ Chapman Internal Type, tilting disc, check valve is installed. Note the simple, welded construction. No bolted gasket joint . . . no maintenance necessary. No reducers in line . . . an easy, low cost installation.

Chalk up another first for Chapman. It's the *New Internal Type* Chapman Check Valve for transmission pipeline use. Into a section of pipe supplied by the purchaser, Chapman welds the complete working mechanism of a Tilting Disc Check Valve, thus providing a Check Valve unit with no bolted gasket joint and eliminating the necessity of reducers in the line. It's lighter in weight, lower in cost, easier to install, yet retains all the advantages of Chapman's Standard Tilting Disc construction: low head loss . . . a quick, quiet, tight closure . . . no slamming . . . no jarring . . . no opening of joints or wear of moving parts. Discs are faced with 12-14 Chrome Stainless. Seat Rings are of 12-14 Chrome Stainless, Malcomized to 900 Brinell minimum for maximum wear resistance. Available in sizes 16″ and larger diameter of pipe opening.

Look into the possibilities of this *New Internal Type* Chapman Check Valve. It's available for a maximum pressure of 1200 p.s.i. cold oil or gas. Write for complete information *today*.



Standard Chapman Tilting Disc Check Valve welded into natural gas transmission line.



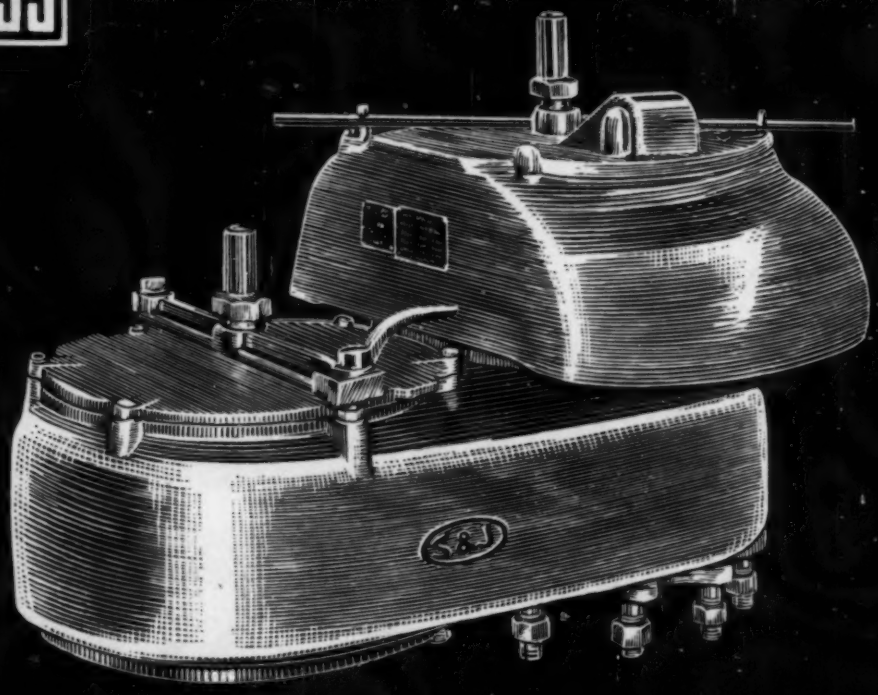

Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

## THE CHAPMAN VALVE MFG. CO.

**INDIAN ORCHARD, MASSACHUSETTS**

# Protect YOUR VALUABLE TANKAGE

## with S&J weatherproof Breather Valves



THE SHAND & JURS poppet type breather valve is designed to deliver the maximum in performance under all weather conditions. It provides exceedingly high flow capacities within the range of normal pressure settings and over-pressure allowances, yet minimizes vapor leakage under the most rugged operating conditions.

Designated by S&J as Fig. ST-6949, this breather valve incorporates the following design features that assure top notch performance:

- Valve pallets automatically drain condensation away from their seats.
- Molded thermosetting phenolic pallets and seats with stainless steel pallet guides, offer maximum resistance to corrosion.
- Completely screened valve openings keep windblown particles, insects, rain, sleet and snow from hindering efficient pallet operation.
- Quickly removable pressure and vacuum hoods for fast, easy inspection.

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342 Madison Ave.

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M & M Bldg.

TULSA
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ENGLAND: Whessoe, Ltd., Sales: 25 Victoria St., London, S.W. 1
Whessoe, Ltd., Works: Darlington, County Durham

# PIPE LINE PROGRESS

## Northern Natural achieves billion cu. ft. daily line capacity... builds with A. O. SMITH LINE PIPE

**Northern Natural Gas Company** this year completes its expanded two-year construction program, with total daily pipe line capacity up to 1,100,000,000 cu. ft. 460 miles of new main line loops were laid in the two-year program, with twelve sections of loop line being laid each year. New line facilities bring natural gas to 71 additional communities in Iowa, Nebraska, Minnesota and South Dakota . . . so that the company now serves a total of 307 communities in the Northern Plains.

**A. O. Smith's** participation in the job consisted of 178 miles of 30-inch pipe and 60 miles of 20-inch pipe.

**Highly regarded** in the industry because A. O. Smith welded steel pipe is consistently accurate in size, roundness and end-to-end matchup. A. O. Smith has supplied all or a part of the line pipe for most major pipe lines in the country.

*A. O. Smith Line Pipe is available in a complete range of sizes and wall thicknesses, from 8⅝-in. to 36-in. diameters.*

The A.O. Smith Casing Mill is operating at capacity to supply vitally needed casing for the Oil and Gas Industry.

*Through research . . . a better way*

**A.O.Smith**

CORPORATION

TUBULAR PRODUCTS DIVISION

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*International Division: Milwaukee 1*



For more data on advertised products, use Readers' Service Cards, last page.

*How GM DIESEL POWER helped lay*

# WORLD'S LONGEST PIPE LINE

**30-inch Lakehead Pipe Line** moves through upper Michigan swamplands, where welders needed platforms to keep from sinking in muck. On this 100-mile section, Midwestern Constructors used a battery of Lincoln portable welding machines each powered by a two-cylinder GM Diesel engine.

**Crossing the Straits**—GM Diesel-powered tugs keep Merritt-Chapman's cable-laying barge on course by running guide lines to buoys for one of the longest and deepest underwater crossings in pipe line history.

**Shooting a "pig"**—Tight-fitting disc, called a "pig," is shot through welded pipe to remove dirt. Air blast is delivered at steady pressure of 100 psi and better by GM Diesel-powered Ingersoll-Rand compressor supplying up to 600 cubic feet of air per minute.

**Digging rock**—Where going was rough, GM Diesel-powered Unit backhoes dug trench. Midwestern used these fast-moving shovels to follow blasters along route. Interchangeability of standardized GM Diesel parts in all equipment simplifies inventory, cuts costs.

**Lining up pipe**—GM Diesel-powered Allis-Chalmers tractors line up 2500-ft. welded pipe sections. They also moved pipe and welding machines and handled many utility jobs. Work gets done faster with smoother-running GM 2-cycle Diesels in your equipment line-up.

CONTRACTORS, with an early winter deadline to beat, depended upon a variety of General Motors Diesel-powered equipment to lay the Lakehead Pipe Line Extension through Michigan and across the Straits of Mackinac in record time.

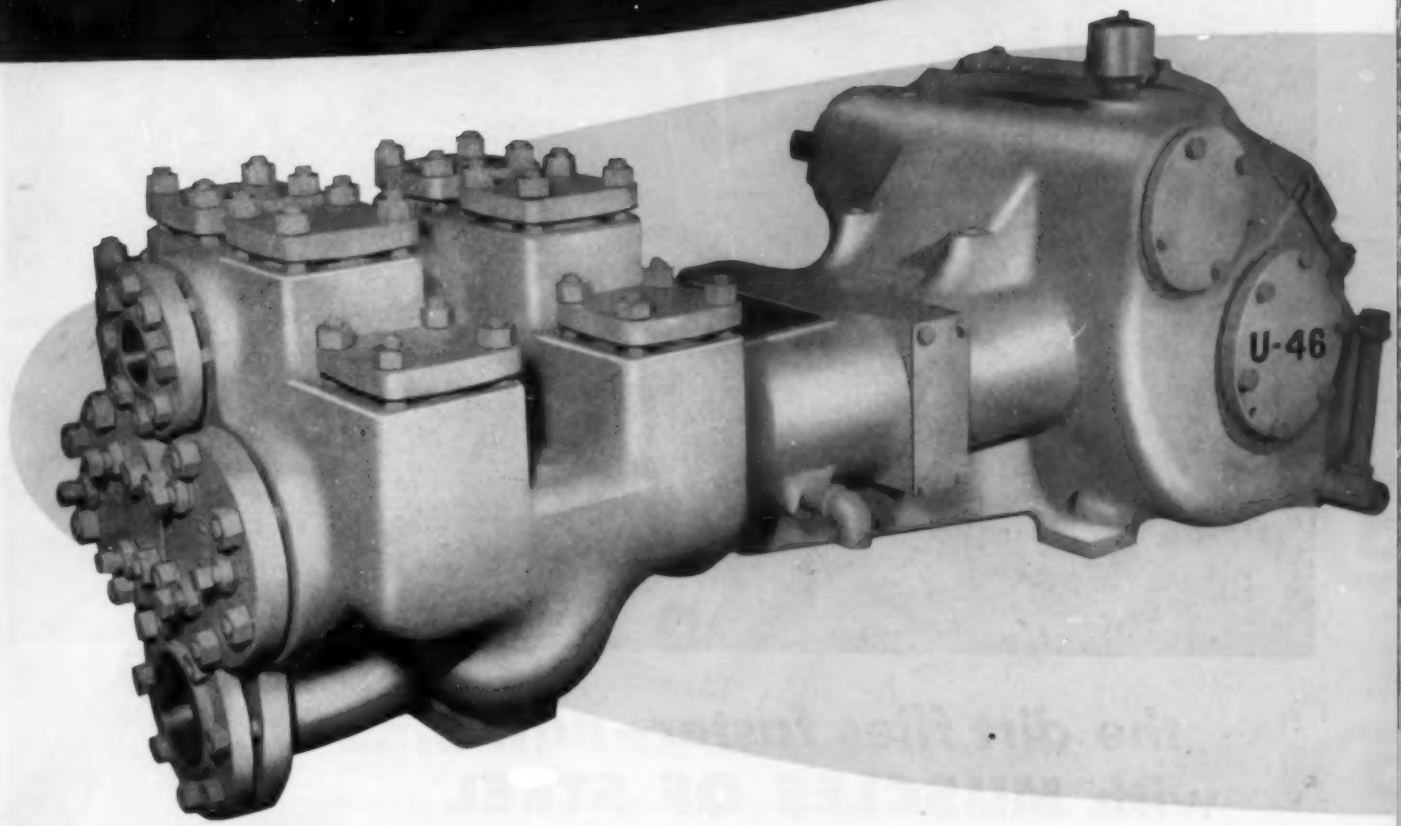
Wherever you have close schedules to meet—or competitive bids to beat—you'll be money ahead with GM Diesel power, because this versatile 2-cycle Diesel gets work done faster at lower cost. Let this great GM Diesel engine prove its superior economy and dependability on *your* job!

*It Pays to Standardize on*

**DETROIT DIESEL**
**ENGINE DIVISION**
GENERAL MOTORS • DETROIT 28, MICHIGAN
*. . . available in more than 750 models of equipment built by over 150 manufacturers*

GM GENERAL MOTORS DIESEL POWER

# You've Never Seen Such a Versatile Pump!




Bethlehem's U-46 is a small pump, but what a busy one! It's intended for general utility work, and we think it's the most versatile unit ever offered for this service.

The U-46 is a horizontal, duplex, double-acting pump with 4-in. maximum liner bore and 6-in. stroke. When used for conventional jobs, such as fresh-water pumping around the rig, it is furnished with alloy cast-iron liners. For handling salt water and other corrosive fluids, bronze liners, piston rods, valves, and valve seats are furnished. All-aluminum-bronze fluid end and accessories are also available. Moreover, fluid-end parts of correct materials can be supplied for oil and drilling-fluid service.

You'll find that your Bethlehem U-46 will seldom be idle. It is as much at home around the lease on gathering work as it is on the rig. This is a handy little unit that fits in anywhere, without fuss or bother. It's so easy to move that setting it up in a new location is never a problem.

The U-46 can be used with any type of prime mover—electric motor, gas or gasoline engine, etc. For further details and specifications, check with the nearest Bethlehem Supply office or store.

*In addition to drilling-rig equipment and a full range of pumping units, Bethlehem offers Beth-Co-Weld line pipe, Purple Strand wire rope, and a complete variety of sucker rods, fasteners, etc. Ask for these products when you are next equipping your oil-country installations.*

**BETHLEHEM SUPPLY COMPANY**

*General Offices:* 21 E. Second St., Tulsa, Okla.
*West Coast Headquarters:* Los Angeles, Calif.
*Export Distributor:* Bethlehem Steel Export Corporation
25 Broadway, New York, N. Y.

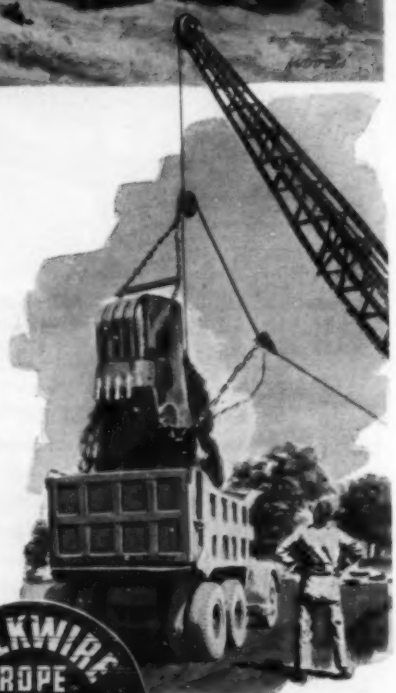
BETHLEHEM STEEL

# *the dirt flies faster—now with* **MUSCLES OF STEEL**

Straining laborers plying pick and shovel are a bygone memory because of today's excavating and road-building equipment. Modern power shovels and draglines use *muscles of steel*—rugged wire rope—to keep the dirt flying fast.

Helping to clear the way for needed highways is another of the important ways in which Wickwire Rope contributes *muscle* to America's might.

You'll find Wickwire Rope, too, in the mines and the quarries . . . in the oil fields and logging camps . . . with the fishing fleets . . . and in numerous materials handling operations. Whatever the job may be, the extra care and quality fabrication that goes into Wickwire Rope proves itself in longer life, more economical service and utmost reliability.



***every industry benefits from wire rope***

**WICKWIRE ROPE**

CFI PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

2533

THE COLORADO FUEL AND IRON CORPORATION—Abilene (Tex.) • Denver • Houston • Odessa (Tex.) • Phoenix • Salt Lake City • Tulsa
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) • New Orleans • New York • Philadelphia

# Let us help you in planning ahead

**One of the most important ways in which we can serve our customers is to assist them in planning for sound growth. Based on past experience and the interpretation of today's business trends, this sound, practical advice is one of the important services offered by The National Bank of Commerce, where every modern banking facility is available to serve its industrial depositors.**

**Make The National Bank of Commerce of Houston your bank, and put these services to work for you.**

## THE NATIONAL BANK OF COMMERCE

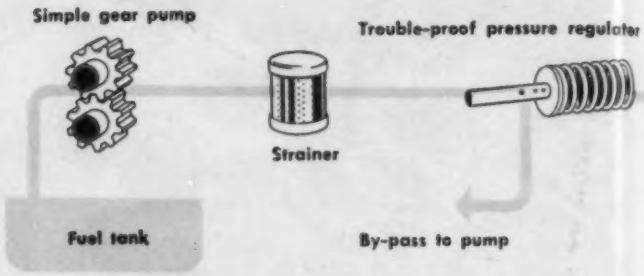
**OF HOUSTON**

*Gulf Building, Houston, Texas "The Bank for All the People"*

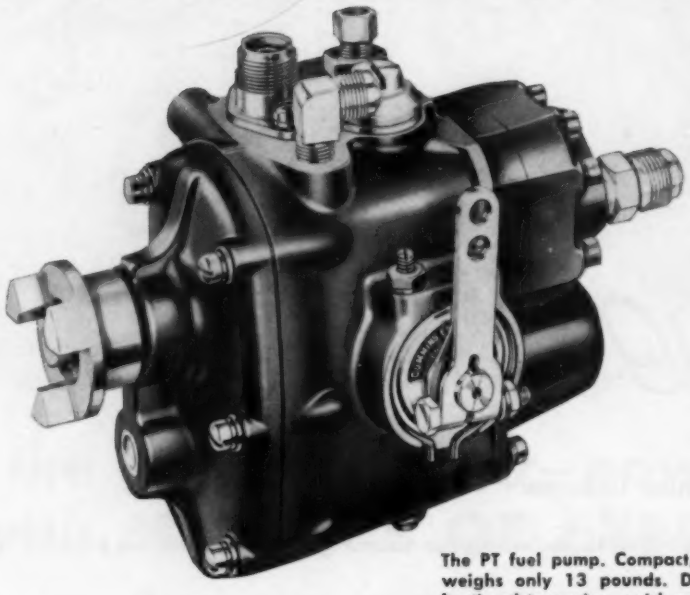
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

# Here's the simplest diesel fuel system ever developed!

**Simplest pump and fuel control arrangement**




## *Cummins new* PT *fuel system... si*

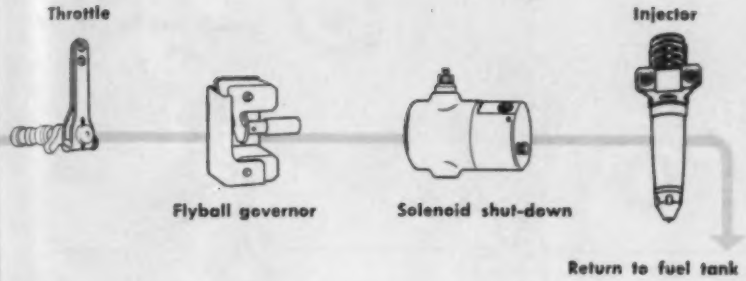


The PT fuel pump. Compact, easy to handle, weighs only 13 pounds. Does not have to be timed to engine, quick and easy to install.

The PT injector utilizes the exclusive Cummins principle of fuel injection which has set the highest standards of performance and economy for more than 20 years.

THE revolutionary new PT fuel system, now standard on all Cummins Diesels, has fewer and far simpler parts than carburetor and ignition systems or ordinary diesel fuel systems. It is easy to understand, simple to work with, can be serviced by any mechanic. No longer any need for fuel system specialists! The PT fuel system has undergone two years of field testing and millions of operating miles under every conceivable condition. Its dependability record is phenomenal. Operators report even less fuel consumption than with earlier Cummins fuel systems and far less cost of maintenance. The PT fuel system can be installed on any Cummins Diesel built since 1932.

**Cummins** *leader in lightweight high speed diesel power 60-600 h.p.*




**PT advantages over gasoline systems:**

- No contact points to adjust
- No condenser to replace
- No spark coil to short
- No wiring harness to short
- No spark plugs
- No vapor-lock problems
- No flooding
- No choking or priming
- No needle valves to clog
- No butterfly valve
- No float level to maintain
- No float valve to stick

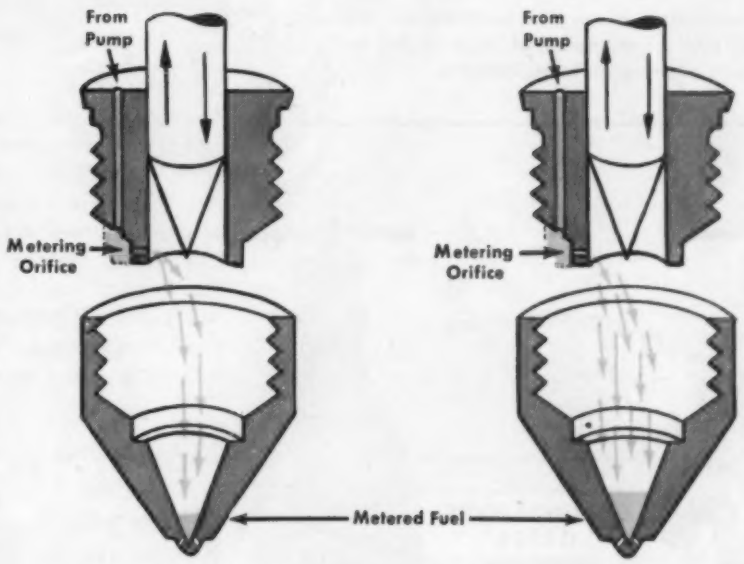
**PT advantages over ordinary diesel systems:**

- No fuel rack adjustments
- No check valves
- No needle valves
- No helixes
- No distributor discs
- No metering pumps
- No high-pressure fuel lines
- No fuel pump timing

## ...m... simpler to work with than gasoline carburetion and ignition

### Simplest Fuel Metering Device

The principle is simply that the amount of fuel flowing through a fixed orifice varies according to the amount of pressure on the fuel. Pressure is controlled by the throttle on the PT pump. Fuel flow through orifice is cut off as injector plunger, actuated by engine camshaft, moves down to inject fuel.




When engine is under partial load, fuel pressure is low, and only a small amount of fuel passes through orifice into injector cup.

When engine is under full load, fuel pressure is increased, and greater amount of fuel passes through orifice into injector cup.

**Mail this today, and get more PT facts!**

**CUMMINS ENGINE COMPANY, INC., Dept. PL-11**
**Columbus, Indiana**

Please send me free illustrated folder, "Cummins PT Fuel System."

Name_____

Company_____

Address_____

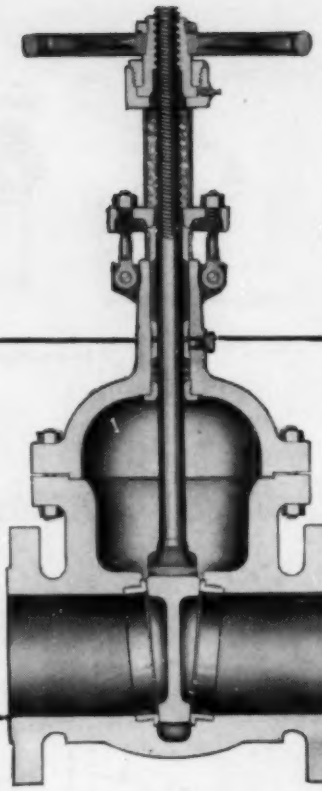
City_____ Zone____ State_____

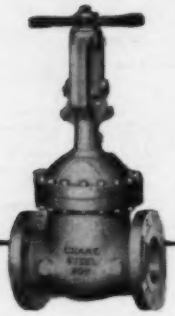
**CUMMINS**

let valves of
known dependability
keep your piping costs
in line

# CRANE

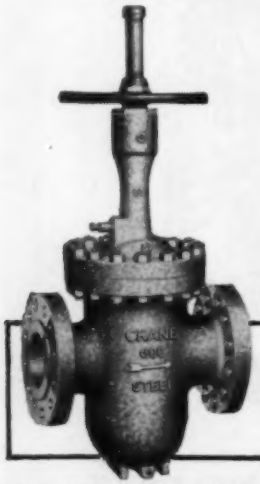
**Here are some of the most famous valves in pipeline service—famous for their greater suitability, dependability, and long-range economy. The consistent success of Crane pipeline valves is easy to understand when you consider the background . . . dating clear back to the early days of the petroleum industry.**





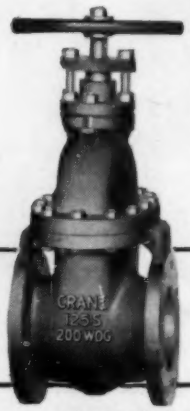
## CRANE CAST STEEL WEDGE GATES

The pioneer steel valve that has never been topped in quality and performance. A stronger and more rugged valve because of Crane skill in steel casting. Dependable wedge gate design with solid wedge-type disc. Long, close-fitting guides assure accurate seating—minimize wear. Crane *Exelloy* trim on all seating surfaces provides the resistance you want against erosion and wear. Deep, lantern-type stuffing box assures tightness and long packing life. Crane Cast Steel Wedge Gates are available in a wide range of sizes with flanged and welding ends; 150, 300, and 600 lb. class.



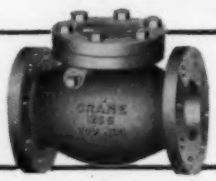
## CRANE CONDUIT-TYPE GATES CLASS 600

Even infrequent operation won't affect their efficiency, for all working parts are sealed in grease. Dual-seating double disc is fully seated in open as well as closed position, thereby solving erosion problems. Conduit-type disc ports coincide exactly with seat openings for smooth, clear flow with minimum pressure drop. Full-Way or Venturi patterns for working pressures up to 1440 pounds, oil or gas. Sizes 2 to 30 inch.



## CRANE IRON BODY WEDGE GATES

You see plenty of these dependable 125-pound Crane valves along the nation's pipelines. Adaptable for all types of services, they feature an exceptionally strong oval-shaped body and bonnet. Available with either double disc or solid wedge disc. OS&Y and non-rising stem patterns, brass trimmed or all-iron. Screwed or flanged end valves available. Complete range of sizes.



## CRANE IRON BODY SWING CHECKS

Well-proportioned, sturdy valves, globular in shape to provide ample flow. *The disc cannot stick in open position.* All-iron or brass trimmed, whichever your service demands. All-iron valves have seating surfaces cast integral with body and disc. Seat ring in brass-trimmed valves is screwed into the body. All sizes have the hinge suspended in the body, permitting simplified change-over to outside lever and weight. Sizes up to 24 inch.

*THE BETTER QUALITY . . . BIGGER VALUE LINE . . . IN BRASS, IRON, STEEL*

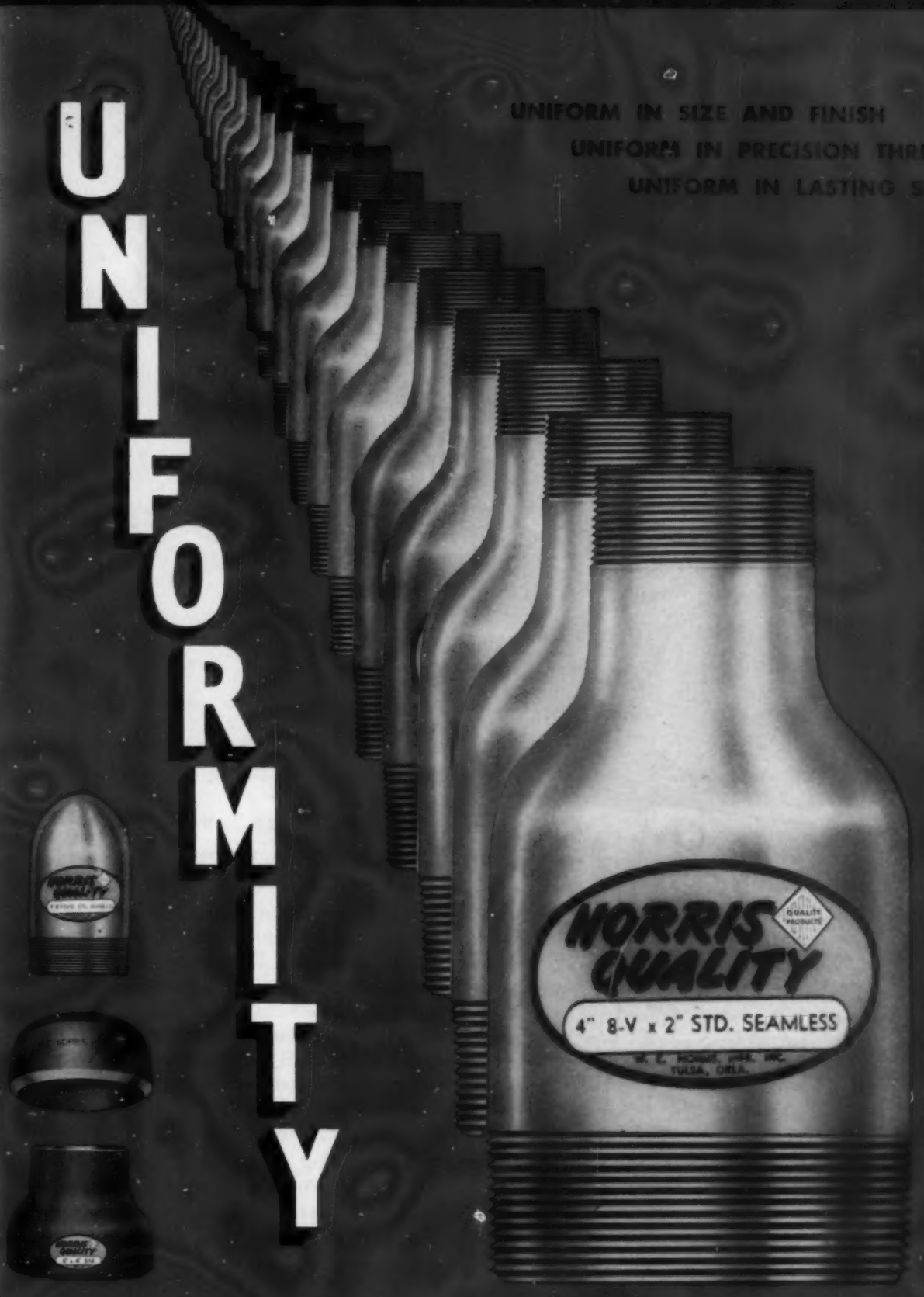
# CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
*Branches and Wholesalers Serving All Industrial Areas*

***VALVES • FITTINGS • PIPE • PLUMBING • HEATING***

# UNIFORMITY

UNIFORM IN SIZE AND FINISH
UNIFORM IN PRECISION THREADING
UNIFORM IN LASTING SERVICE




## W.C. NORRIS, MANUFACTURER, INC.

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WEST COAST DISTRIBUTORS:
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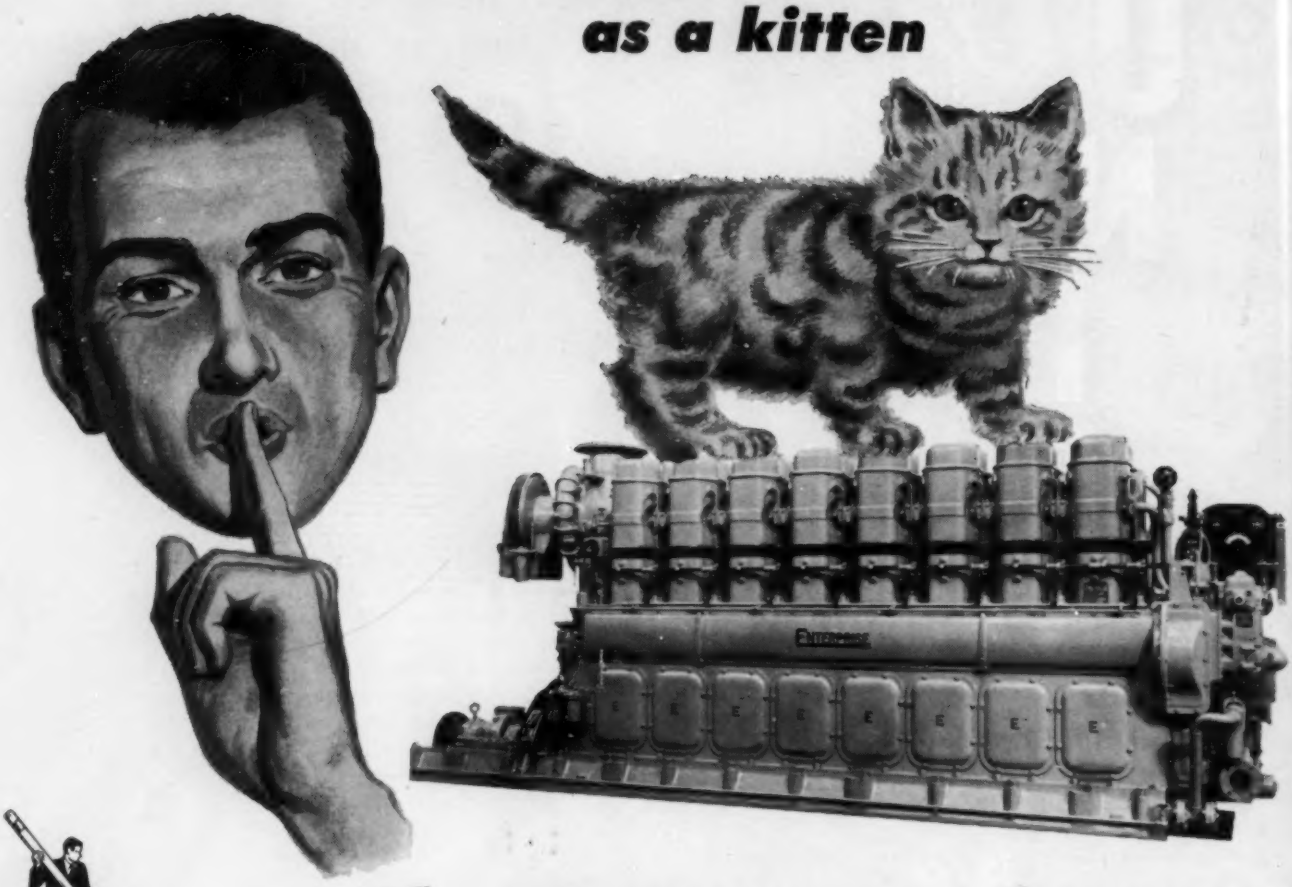
# QUIET
## *as a kitten*



### Check these points on Enterprise Quiet-Running Diesels

- Complete precision surface finishing of all moving parts to close tolerances permits accurate control of weights and balances, helps keep noise and wear to a minimum.
- Conservative speed ratings result in major reduction of noise.
- Carefully engineered injection system minimizes "injection knock."
- Base, block, gear case and cylinder heads are of heavy-sectioned cast iron, providing a maximum damping of internal noise.
- Water jacketed manifolds absorb exhaust noises.
- Modern design decreases flat external surfaces which act as sounding boards.

**There is nothing finer in Heavy-Duty Diesels!**

### ENTERPRISE has cut "Noise Level" to a minimum —all parts hum smoothly, wear longer

Enterprise has gone far in taking the head-splitting noise and damaging vibration out of diesel operation. From base to manifolds, ENTERPRISE Diesels are carefully engineered and constructed to overcome harmful vibrational effects and noise—without sacrificing any of the famous ENTERPRISE high performance features. By all comparison, the resulting smooth operation is "quiet as a kitten." A low noise and vibrational level means less wear, lower maintenance cost, higher overall efficiency and economy.

This is but another of the many plus values enjoyed by ENTERPRISE customers the world over. Get all the facts...and your choice, too, will be ENTERPRISE.

*Write for descriptive bulletins, or call your nearest* ENTERPRISE *Diesel Sales office.*

**Enterprise**
DEPENDABLE
**Diesels**

**ENTERPRISE ENGINE & MACHINERY CO.**
*18th & Florida Streets, San Francisco 10, California*
A SUBSIDIARY OF MINERAL METALS CORPORATION
Boston · Chicago · Denver · Kansas City · Los Angeles
Minneapolis · New Orleans · New York · San Diego
San Francisco · Seattle · St. Louis · Washington, D. C.
DIESEL ENGINES • OIL BURNERS • PROCESS MACHINERY

# WITH CAT-BUILT EQUIPMENT

This Cat* D6 Tractor with No. 6A Bulldozer and Hyster winch is one of 34 rugged yellow units used on a 164-mile section of 30-inch line for the El Paso Natural Gas Co. Contractor doing the job is Western Pipeline Constructors, Inc., Austin, Texas. Here the D6 backfills a stretch between Ashfork and Williams, Arizona. General Superintendent W. B. Williams says: "Caterpillar-built machines are the heart of our pipeline construction equipment."

Like all equipment built by Caterpillar, the D6 with angling bulldozer is built to do *more* work at *lower* cost with *less* down time than any unit in its class. Power, weight and traction are *matched* for *maximum* bulldozer production. Notice the *rolling* action of the blade, which is reinforced to handle heaping loads and has reversible cutting edges of high-carbon steel for longer wear. Notice operator visibility, too—a clear view that, along with ease of handling, speeds up work. There's easy changing of blade positions, also—a one-man operation to angle 25° left or right. These are just a few of many details that add up to money-making performance in typical, tough pipeline terrain.

Standardizing on Caterpillar-built equipment pays off many ways. For example, many parts are interchangeable. Operator and mechanic familiarity with one make means bigger production and less time spent on maintenance. And there's a big saving on one-stop service from your Caterpillar Dealer, who has the organization and stock of genuine parts to provide fast service *whenever* and *wherever* you need it.

The D6, like the D7 and D8, now comes equipped with a new oil-type flywheel clutch. On-the-job records show that this clutch provides much longer periods between adjustment and replacement than is possible with the conventional dry clutch. Get the facts about this money-making machine from your Caterpillar Dealer. Ask for a demonstration on your job!

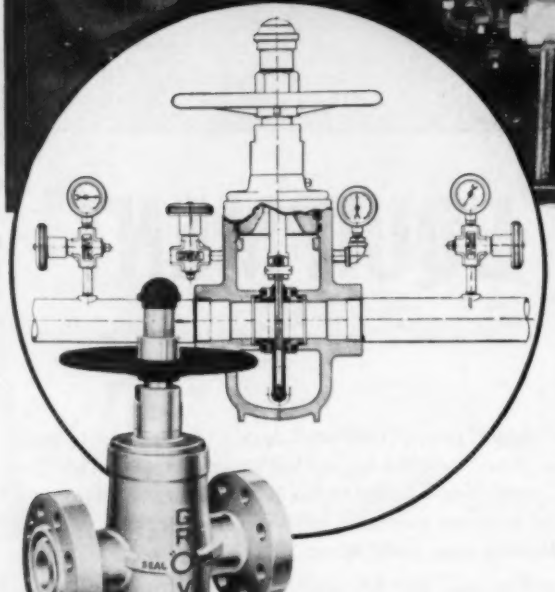
Caterpillar Tractor Co., Peoria, Ill., U.S.A.

**CATERPILLAR***

*Both Cat and Caterpillar are registered trademarks—®

KEEP ON SCHEDULE
WITH CAT EQUIPMENT

# WE'LL MAKE THIS TEST WHEREVER YOU SUGGEST




Body cavity pressure is bled to a specific differential from upstream. Dead-tight seal is verified by non-variance of cavity pressure gauge.

***The only gate valve you can check in the line—any time.***

**SEE FOR YOURSELF HOW GROVE SEAL-"O"-RING GATE VALVES CAN BE CHECKED IN THE LINE...for positive dead-tight seal and free-moving gate action**

Your Grove sales engineer is equipped to demonstrate this new field method of testing and checking the dead-tight seal and free-moving gate action of Grove Seal-"O"-Ring Gate Valves—*right in your office,* or wherever you suggest. Simulating actual conditions, this test proves conclusively that Grove Seal-"O"-Ring Valves hold tight as a line blind, yet permit free movement of the hand-wheel at all times. Also, excess body cavity pressure is automatically relieved *internally* to the upstream line by piston-action of Seal-"O"-Ring seat assemblies, actuated by pressure differential. This test set-up shows how you can install this system for checking Grove valves right in the line—at any-time—without loss of gas or liquid. You must see it—to believe it. Contact your nearest Grove District Office today, to arrange for test demonstration.

## GROVE SEAL-"O"-RING Gate Valves

**Grove Valve and Regulator Company • 65th & Hollis Sts., Oakland 8, California**

GROVE SIMPLICITY ACCURACY SAFETY

HOUSTON 4 — 1901 Calumet St. • LOS ANGELES 14 — 649 So. Olive St. • NEW YORK 17 — 415 Lexington Ave.

CORPUS CHRISTI, TEXAS ODESSA, TEXAS DALLAS, TEXAS TULSA, OKLAHOMA LAFAYETTE, LA. SHREVEPORT, LA NEW ORLEANS, LA. DENVER, COLO.

# NOW YOU CAN SHOW YOUR PIPE LINES ON THIS UNUSUAL NEW RELIEF MAP

Show your pipe lines in detail on this big, new, three dimensional map of the United States. With your pipe lines or service areas delineated, this plastic relief map is a handsome addition to executive offices, conference rooms or reception offices.

**NEVER BEFORE A RELIEF MAP WITH ALL THESE FEATURES!**

Sixty-four by forty inches (large enough for effective display) this map weighs only 2¼ pounds. Beautifully lithographed in 11 colors . . . formed from a single sheet of durable Vinylite plastic. You can see *and* feel the relief features. Shows more than 2,000 cities . . . many lakes, rivers, parks, national monuments. Self-framed. Easy to hang as a picture.

**ORDER YOURS NOW!**

AERO delivers your map to you flat and unformed, so your draftsmen may readily draft your pipe lines on the map. The map is returned to us, and we form it into a true relief map, showing your lines in relation to our country's topography. And—we lacquer the map to protect the surface through long years of use. Total cost for these unique maps—$50.00 each, delivered anywhere in the U.S.A. Order yours today.

*Aero is now accepting pre-publication orders for similar plastic relief maps of Canada, New Jersey, and California.*

## AERO SERVICE CORPORATION

PHILADELPHIA 20, PENNSYLVANIA

*Oldest Flying Corporation in the World*

*Affiliates in:* TULSA, SALT LAKE CITY, OTTAWA

AIRBORNE MAGNETOMETER SURVEYS • PRECISE AERIAL MOSAICS
SCINTILLATION COUNTER SURVEYS • TOPOGRAPHIC MAPS
PLANIMETRIC MAPS • RELIEF MAPS • SHORAN MAPPING



For more data on advertised products, use Readers' Service Cards, last page.

# Low... ACCIDENT RECORD

## due to REGULAR SAFETY MEETINGS

### WE QUOTE FROM A POLICYHOLDER'S LETTER

"We are pleased to acknowledge receipt of our dividend check in the amount of $4,682.06, which, with our Guaranteed Cost Discount, equals a 49.22% savings on our Workmen's Compensation Insurance.

"The service rendered by your office, and particularly the engineering and claims staff, has been most helpful in bringing about this reduction in our insurance costs. This type of service is unique with your company, and we are glad to pass this good word along so that other employers may benefit as we have. We can also attribute the low accident record to our regular meetings with our employees. At each of these meetings, we impress the importance of being careful and watching out for hazards and danger spots in the plant.

"The Texas Employers' Insurance Association have proven to our satisfaction that they can and do reduce insurance cost."

*What* **POLICYHOLDERS** *Say*

This is one of many testimonial letters received from policyholders of the Texas Employers Insurance Association. These letters tell what policyholders think of the Service and Savings received from the Association.

Ask the Texas Employers representative nearest you to show you more of these letters, as proof of what Texas' largest writer of Workmen's Compensation Insurance can do for you.

40TH ANNIVERSARY 1914-1954

*Largest Writer of* WORKMEN'S COMPENSATION INSURANCE *in Texas*

**TEXAS EMPLOYERS INSURANCE ASSOCIATION**
HOME OFFICE - DALLAS, TEXAS

Service Offices: ABILENE • AMARILLO • AUSTIN • BEAUMONT • CORPUS CHRISTI • DALLAS • EL PASO FORT WORTH • FREEPORT • GALVESTON • HARLINGEN • HOUSTON • LUBBOCK • MIDLAND ODESSA • PORT ARTHUR • SAN ANGELO • SAN ANTONIO • SHERMAN • TYLER • WACO • WICHITA FALLS

# *Manifolds* ARE THE PROVING GROUNDS *for* ROCKWELL-Nordstrom VALVES

In large manifolds, the superiority of Rockwell-Nordstrom valves quickly becomes apparent. Large numbers of Rockwell-Nordstrom valves, sometimes in company with other types of valves, are installed on lines that are operated frequently. It's easy to compare Nordstrom's trouble-free performance with that of ordinary non-lubricated valves.

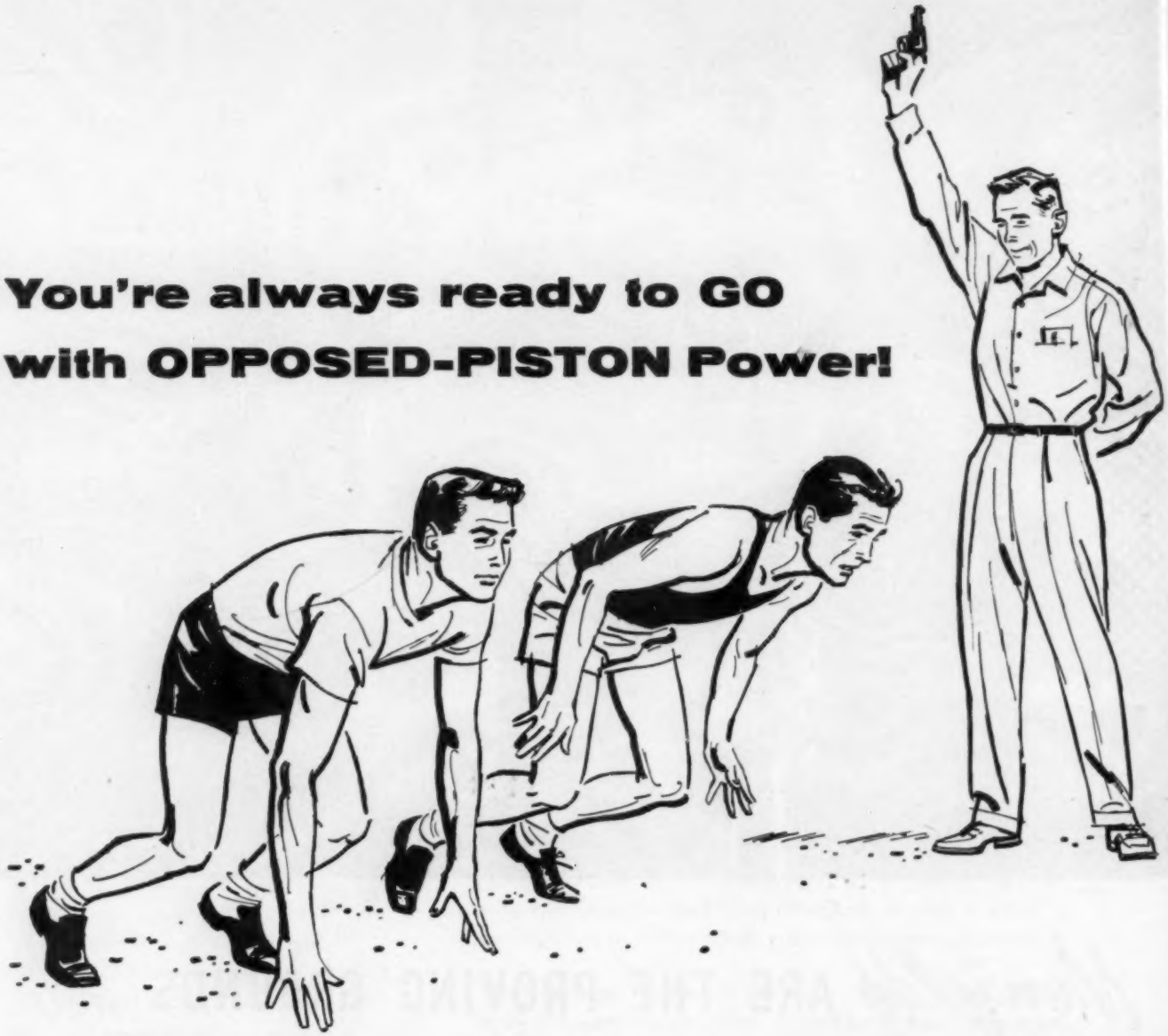
Field testing of this kind is the best salesman Rockwell has. It proves that Nordstrom valves, with their exclusive system of pressurized internal lubrication, seal more tightly, last many years longer and operate more easily than any other type of valve.

Take a tip from manifold operators who have judged the performance of hundreds of valves. Install Nordstrom. For additional information on Nordstrom valves, write: Rockwell Manufacturing Company, Pittsburgh 8, Pa. *Canadian Licensee: Peacock Brothers Limited*

**ROCKWELL-Nordstrom VALVES**

*Lubricant-Sealed for Positive Shut-Off*

# You're always ready to GO with OPPOSED-PISTON Power!

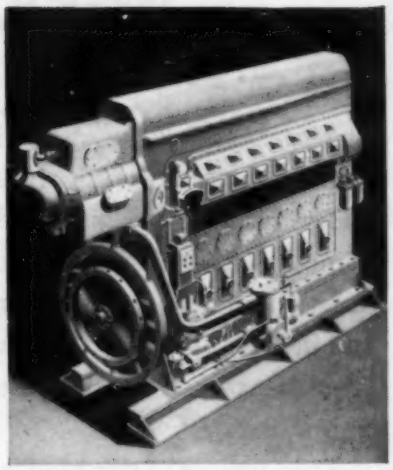


Take it either way . . . for fast starts or high availability . . . the Fairbanks-Morse Model 38F 90 diesel can't be beat for pipe line pumping. Whether you pump with diesel power 365 days of the year, or only during emergencies, no other engine can approach the dependability, maintenance economy and compactness of its Opposed-Piston design.

The Model 38F has minimum rotating masses, perfectly balanced . . . it can be brought up to full speed and placed on the line in less than 15 seconds. And 40% fewer moving parts also mean there are 40% fewer reasons for this engine to break down. Consequently, availability is higher . . . maintenance costs exceptionally low.

Compactness is another distinction of Opposed-Piston design . . . here is an engine that's 20% smaller and lighter than any other engine in its horsepower range . . . a big point to consider when pump sites are remote and building costs are high.

Other O-P advantages are three-way fuel options . . . diesel, dual-fuel or spark ignited gas . . . wear-free aluminum bearings, and maximum interchangeability of parts. Call your nearby Fairbanks-Morse Diesel Oil Field Expert, or write to Fairbanks, Morse & Co., Chicago 5, Illinois.

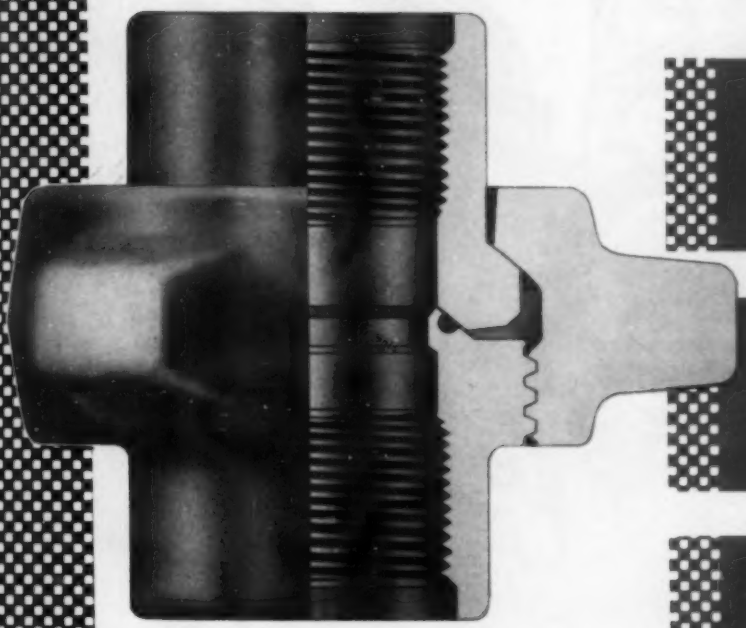


**FAIRBANKS-MORSE**

*a name worth remembering when you want the best*

OIL FIELD EQUIPMENT • PUMPS • SCALES • ELECTRIC MOTORS • GENERATORS • LIGHT PLANTS • DIESEL, DUAL FUEL & GASOLINE ENGINES • MAGNETOS • DIESEL LOCOMOTIVES

# Here's everything you've ever wanted in a union... and then some*



HOLDS HIGH PRESSURES WITH THE NUT ONLY HAND TIGHT.

PROVIDES FOR A MISALIGNMENT OF FIVE DEGREES OR ONE INCH IN ONE FOOT IN ANY DIRECTION FROM CENTER LINE.

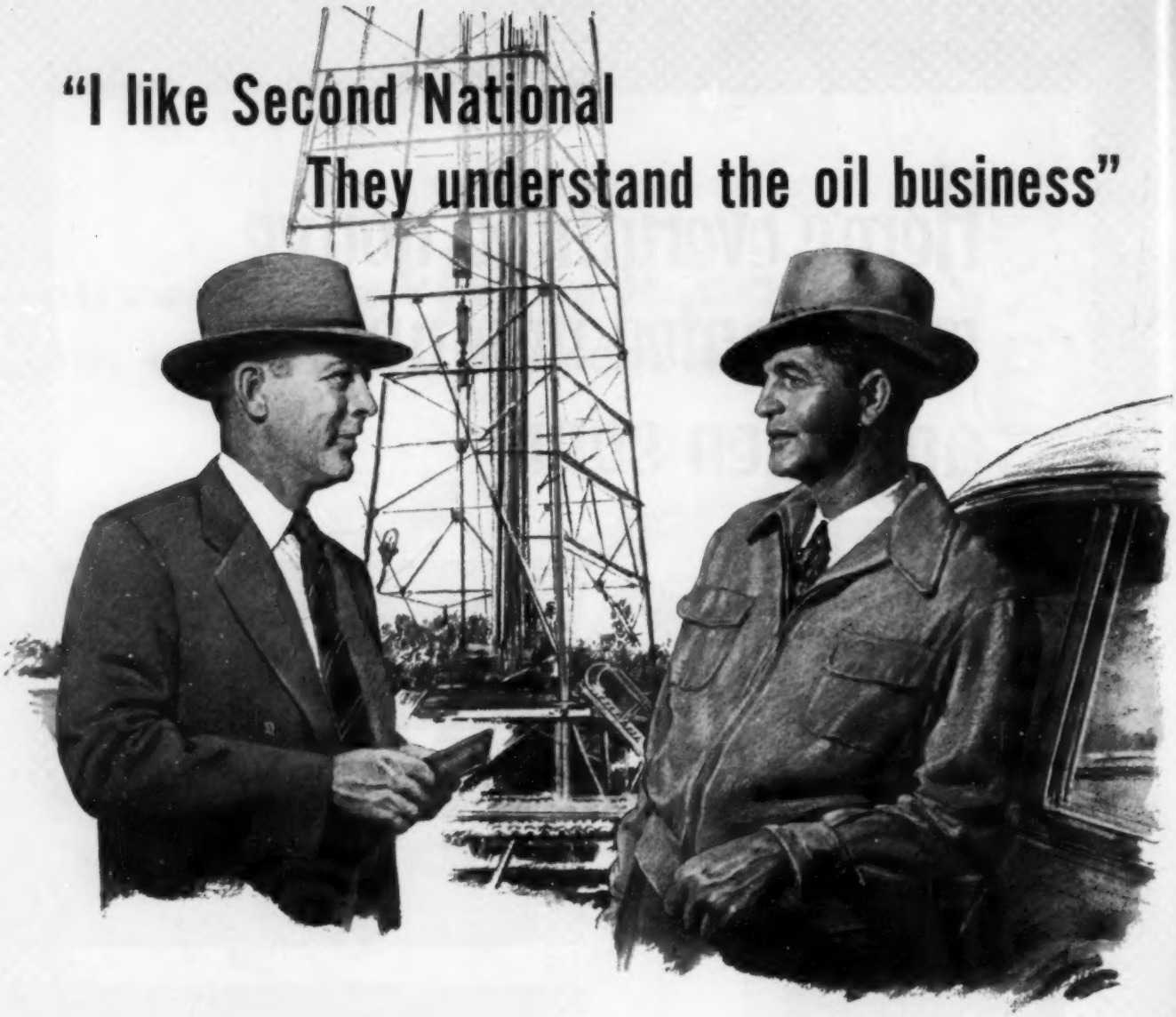
ELIMINATES THE NEED FOR FORCING THE PIPE INTO PERFECT ALIGNMENT IN ORDER TO TIGHTEN THE NUT.

THE "O" RING TYPE UNIONS THAT MAY BE USED TO FULL RATED PRESSURES WITH OR WITHOUT THE "O" RING.

*All the best features of O-C-T's tried and proved features are combined with an improvement incorporating an "O" ring seal in O-C-T acme ball seat misaligning wing unions. The misaligning feature eliminates thread "bind" in mud lines and steam lines which is a common cause of leakage around drilling rigs and other installations. Because they can be used with or without the "O" ring, Type CO unions are the only "O" ring type union suitable for use on steam and high temperature lines. Ask your supply store. Available through more than 700 store locations.

**OIL CENTER TOOL COMPANY • HOUSTON, TEXAS**

# "I like Second National They understand the oil business"



"Whatever I need, whether it's an oil loan, or the latest statistical information on oil and gas operations . . . I've learned that I can rely on Second National.

"The men in their Oil and Gas Department are graduate petroleum engineers and geologists. They're always ready to pitch in and help—and they *know* the oil business."

Oil men like Second National . . . an *oil minded* bank.

*47 Years of Service to the Southwest*

**SECOND NATIONAL**
Bank of Houston

CAPITAL AND SURPLUS 20 MILLION DOLLARS
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

*Packaged Compressor Plant*

Lowest Cost Per Horsepower Installed

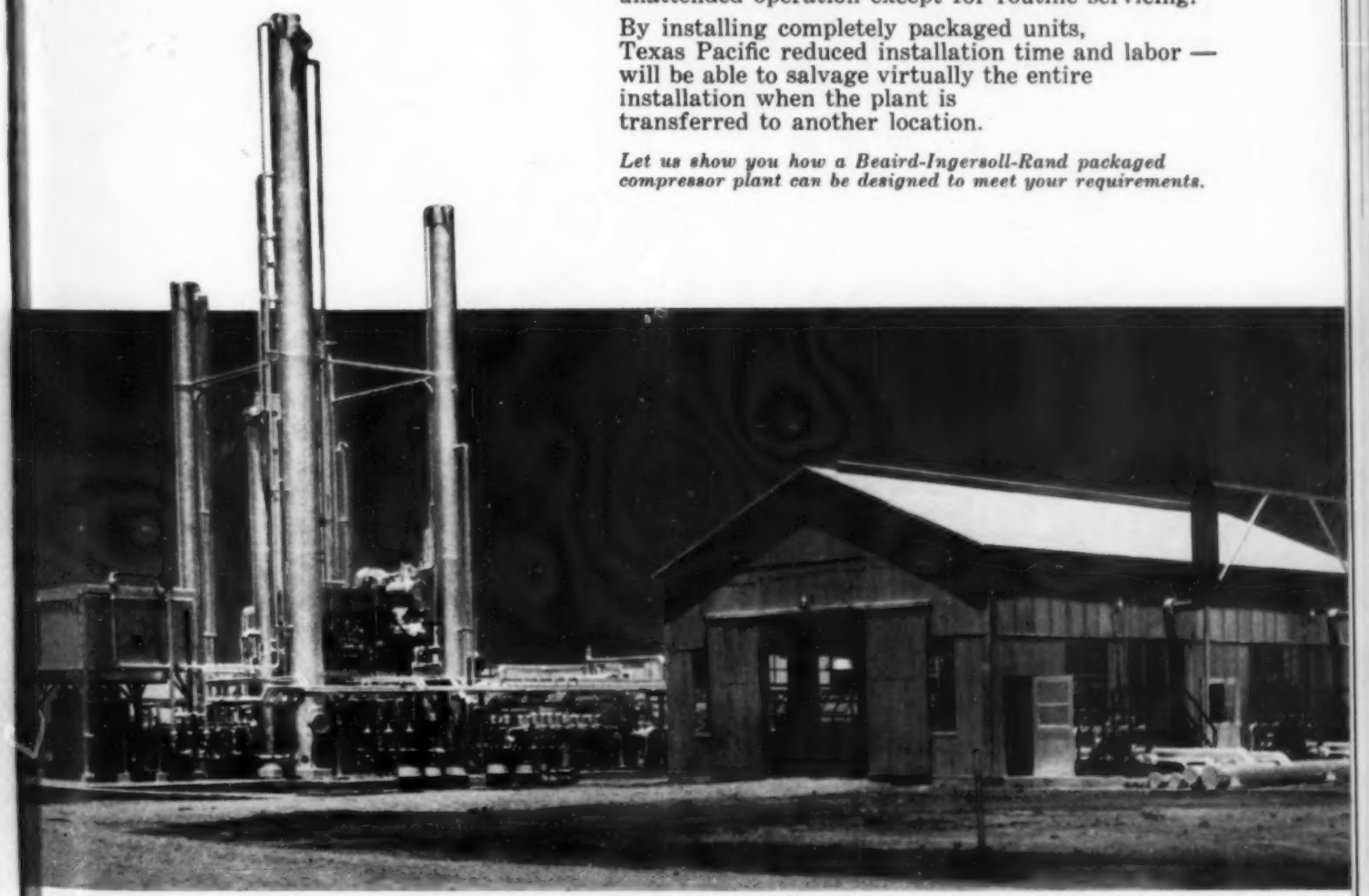
## PACKAGED COMPRESSORS FOR GASOLINE PLANT

TEXAS PACIFIC COAL AND OIL COMPANY recently opened a compression-refrigeration type gasoline plant near Hamlin, Texas. The multiple compression tasks required in this process were entrusted to two 550 h.p. Beaird-Ingersoll-Rand packaged compressor plants. Each unit uses three stages to raise raw gas from 0 to 530 psig. The fourth cylinder compresses propane used as a refrigerant in the process. Plant vapors are collected and delivered into the sales line by a fifth cylinder added to one of the compressor plants.

To assure continuous operation, Texas Pacific installed two packaged units rather than one large compressor of equal horsepower. Plant pressures and operations can be maintained, when necessary, by one unit, while the other unit is shut down for maintenance or repair — with the loss of only a portion of the plant's total producing capacity. Automatic controls built into the units permit their unattended operation except for routine servicing.

By installing completely packaged units, Texas Pacific reduced installation time and labor — will be able to salvage virtually the entire installation when the plant is transferred to another location.

*Let us show you how a Beaird-Ingersoll-Rand packaged compressor plant can be designed to meet your requirements.*



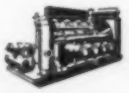
Texas Pacific Coal and Oil Company's packaged compressor plant, Velta Plant, Fisher County, Texas—equipped with two Beaird-Ingersoll-Rand 550 h.p. 10 SVG FOUR CYCLE gas engine driven compressors, Young radiators and all necessary equipment and controls. Other sizes 110 to 660 h.p.

**THE J. B. BEAIRD COMPANY, INC.**

*Shreveport, Louisiana*

**BEAIRD**

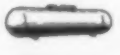
MACHINING MANUFACTURING STEEL WAREHOUSE



PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE



ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

# NEW

**EXTRA CAPACITY**

**35,000 TO 75,000 GALLONS**

## BEAIRD PRESSURE STORAGE TANKS

Now . . . substantial savings can be made in pressure storage plant installations by specifying Beaird Extra Capacity Tanks available in a range of sizes from 35,000 to 75,000 gallons. Extra capacity storage will save installation cost by — eliminating expensive duplication of fittings, connecting piping and reducing operating manpower. Designed to your individual plant requirements, Beaird Extra Capacity Pressure Storage Tanks provide maximum storage at lowest cost per gallon.

Other Beaird Pressure Storage Tanks are available in a range of standard sizes from 2,000 to 30,000 gallons. All pressure tanks are inspected, tested and X-rayed. Modern radiographic equipment at Beaird has put X-ray on a production line basis.

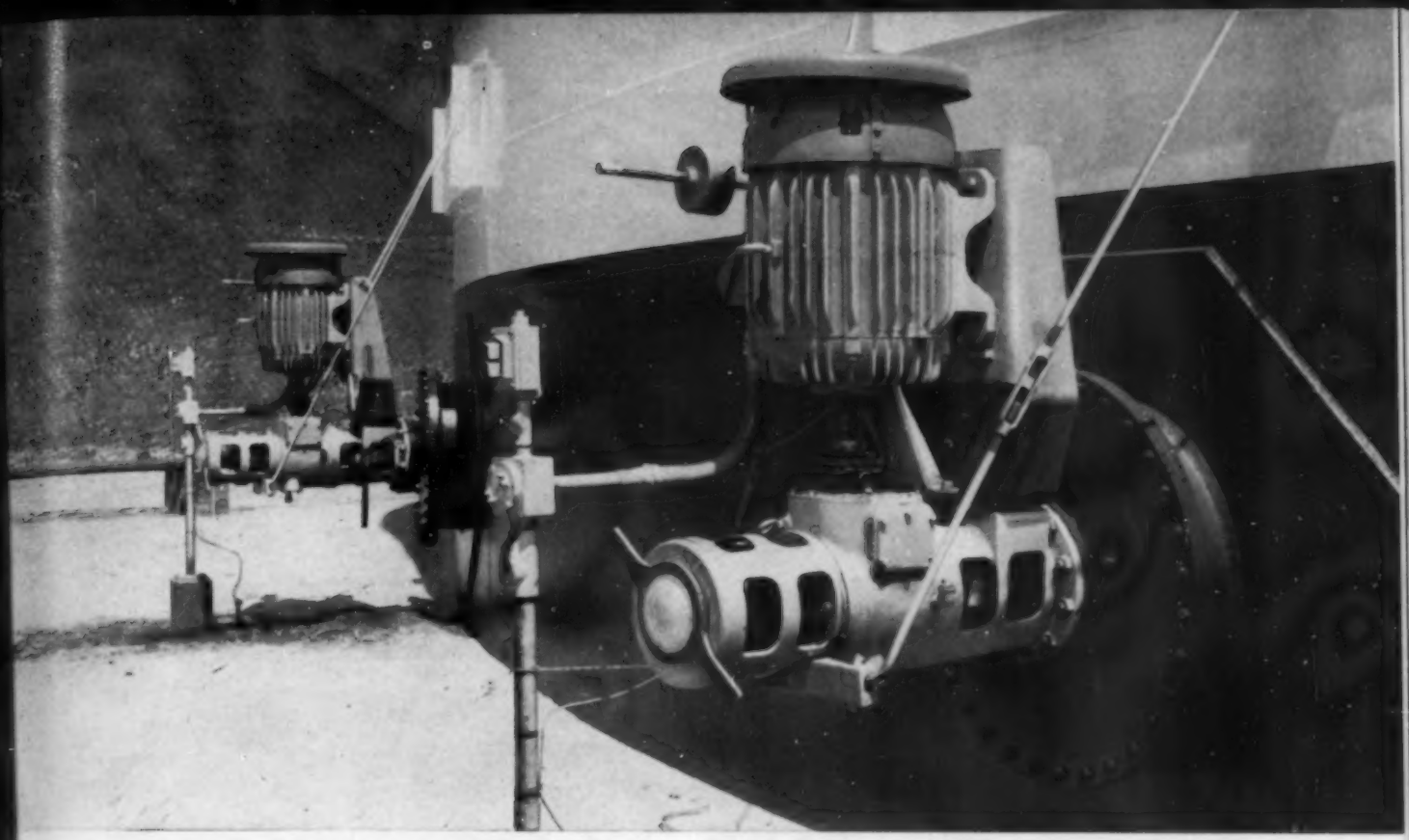
Write today for further information or quotation on Beaird Pressure Storage Tanks designed to fit your requirements.

Weighing only 138,000 pounds, this Beaird 70,000 gallon pressure storage tank is one of the largest in the industry. 130" in diameter and 107' 3" in leng

*Over two hundred million gallons experience*

THE J. B. BEAIRD COMPANY, INC., SHREVEPORT, LOUISIANA

BEAIRD



# NO SEDIMENT in 4½ Years!

## Read how a major pipeline company handled 75 million barrels of Kansas crude—with no time out for sludge removal

Ordinarily 5 feet of sediment and paraffin would have accumulated in the 80,000-barrel tank in 4½ years.

But a LIGHTNIN Mixer kept the contents moving, and prevented the sludge-forming fractions from settling to the bottom.

You can easily see how this mixer paid for itself several times over:

1. By eliminating an expensive cleaning job. This would have cost as much as the mixer—just once.
2. By keeping the tank in service—no downtime for cleaning.
3. By keeping the tank's storage capacity at its full value. Five feet of sludge would have reduced capacity by 10,000 barrels.
4. By realizing profits from all merchantable fractions. They were disposed of as rapidly as they were received.

LIGHTNIN Mixers in your crude storage tanks will save you more than their cost in a short time, and will continue to pay dividends for many years.

**You take no risk when you buy a LIGHTNIN Mixer.** Every LIGHTNIN Mixer is unconditionally guaranteed to do the job you expect of it. Hundreds of LIGHTNINs have been in service 20 years or more.

LIGHTNIN Mixer design makes maintenance easy, too.

Corrosive, abrasive materials in the tank can't hurt bearings—they're safely outside the tank.

You can repack the LIGHTNIN stuffing box quickly under a full head of liquid in the tank, without losing a pint of product.

Or you can eliminate repacking entirely, by using the new LIGHTNIN rotary mechanical seal that requires no adjustment during its lifetime.

Don't let sludge go on stealing your profits. It's easy to plug this profit leak—and scores of pipeline operators are doing it, with LIGHTNIN Mixers. For complete information, call in your LIGHTNIN representative. Or just mail the coupon today.

**Lightnin® Mixers**

**MIXCO fluid mixing specialists**

## MIXING EQUIPMENT Co., Inc.

196-m Mt. Read Blvd., Rochester 11, N. Y.

*In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.*

Please send me, without obligation:

☐ B-503—Four-page illustrated bulletin giving complete information on B. S. & W. control.

☐ B-104—New 20-page illustrated catalog containing full descriptions, specifications and dimensions of LIGHTNIN Side Entering Mixers.

Name_____ Title_____

Company_____ Address_____

City_____ Zone____ State_____

# WEIGH LESS

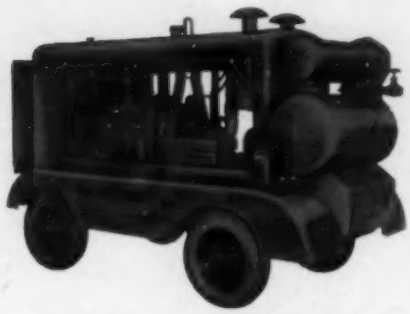
***Capacities:* 125, 210, 365, 600 cfm.**

## . . . CP ROTARY COMPRESSORS

After 18 months of proving themselves on the job, CP Power Vane Rotary Compressors are now available in sizes of 125, 210, 365, and 600 cfm. Having no pistons, connecting rods, valves or other reciprocating parts to maintain, they afford thousands of hours of trouble-free service. Their oil injection system provides copious lubrication, cools the air during compression and assures long rotor blade life . . . yet oil consumption is remarkably low and air is delivered practically oil-free.

Smooth running CP Rotary Compressors also have a variable speed capacity regulator which prolongs life and reduces wear and tear . . . increases over-all economy. CP Rotaries are available with Hercules gasoline and General Motors diesel engines. For more information, write for Bulletin SP-3084-2. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

# THAN PISTON TYPES OF HALF THE CAPACITY...



## Three ways better...

1 **Tapered roller bearings** maintain centering of rotors between head plates; restrain axial movement.

2 **Pressure-matic drive** transmits full engine power; its flexibility protects compressor and engine shafts by automatically absorbing shock.

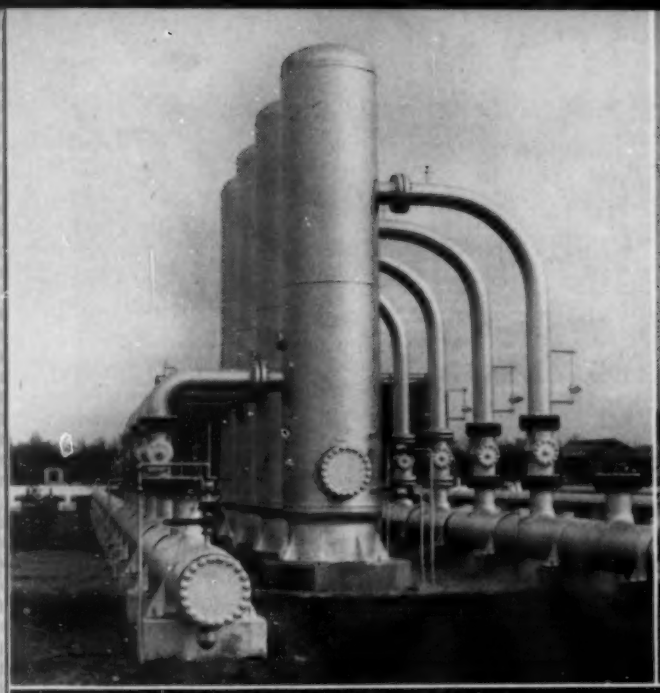
3 **Fitted-step construction** assures perfect running alignment of all parts and joining of all housing surfaces.

## IDEAL WHERE **PORTABILITY** AND **RELIABILITY** COUNT!

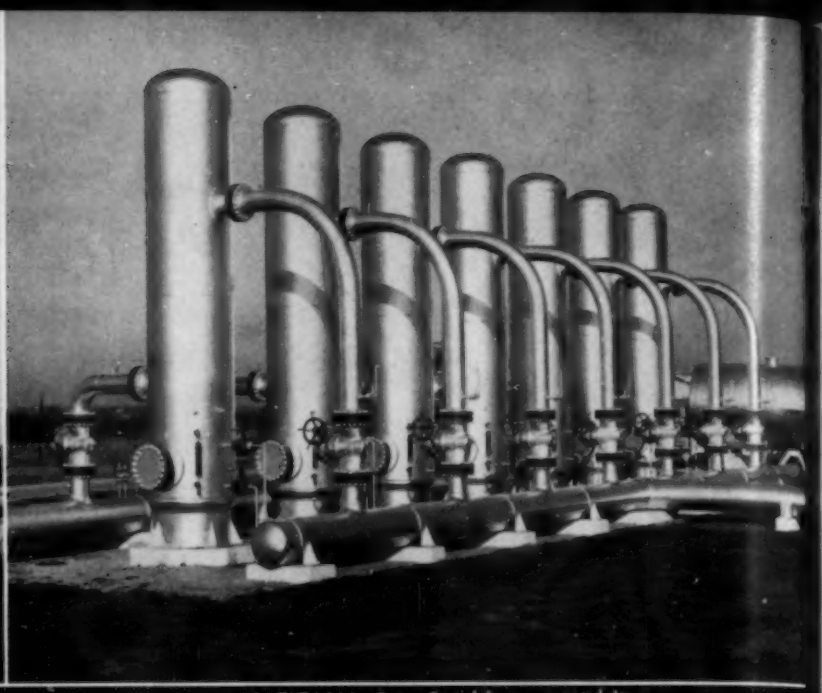
- CP Portable Power Vane Rotary Compressors occupy 30% less space than equivalent piston type machines.
- Compressor weighs less, is more compact than piston type machines of half the capacity.
- Due to oil injection, discharge air is 100° lower than in equivalent piston type compressors.
- Spring suspension, automotive steering on four wheel models, tilt operation, compactness and light weight make CP Rotary Compressors ideal for towing and maneuvering anywhere.
- Rotary shaft seal at drive end excludes dirt from shaft bearings.
- Automatic safety controls stop engine in case of excessive water temperature or oil failure.

**Chicago Pneumatic** 8 East 44th Street, New York 17, N. Y.

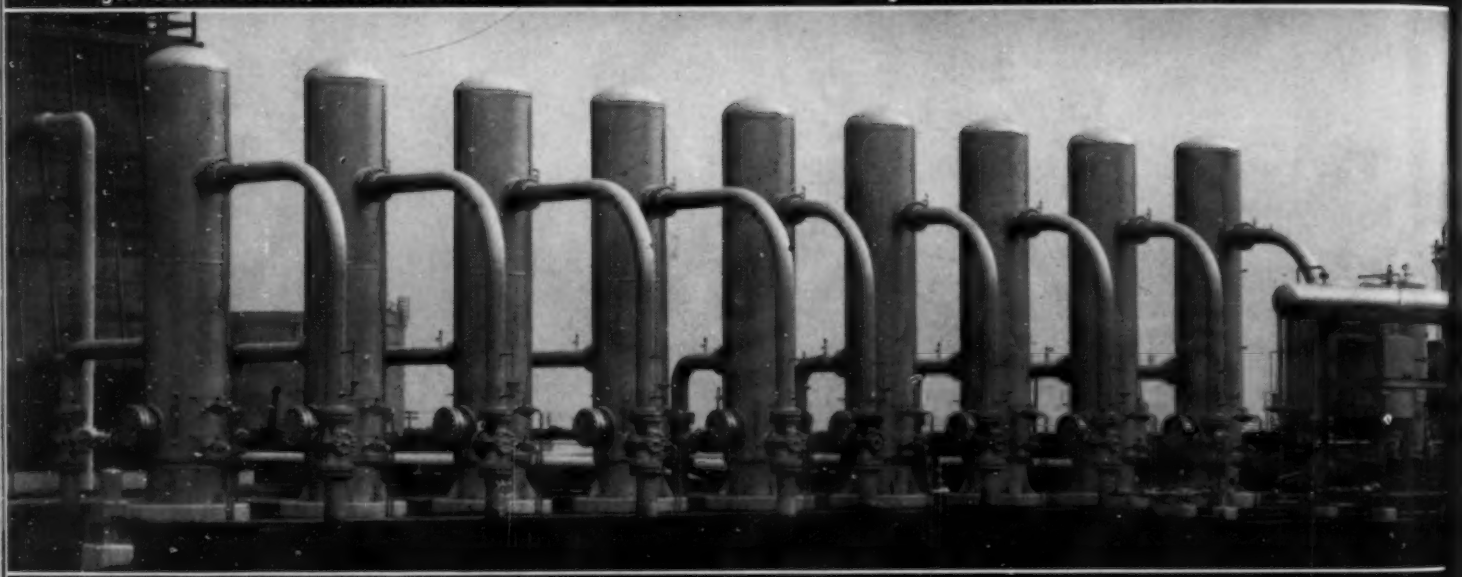
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



NATIONAL Gas Scrubbers, main line gas booster station, Batesville Miss.



NATIONAL Gas Scrubbers, main line gas booster station, Monroe, La.



NATIONAL Gas Scrubbers, main line gas booster station, Banquitte, Texas

# NATIONAL WET-TYPE SCRUBBERS

## 54" O.D. x 20' — 750 PSI MAX. WP.
## 90 MM CU. FT./DAY. 12" INLETS AND OUTLETS

The service required of Wet-Type Scrubbers! Pipe line dust and other foreign materials are removed ahead of compressors at each pressure boosting station. This is done best by passing the gas through a special oil bath in a National Wet-Type Scrubber, then removing the liquid particles from the gas stream when passing through the National Gas Scrubbing element in the top part of the Scrubber.

National Vertical and Horizontal Gas Scrubbers are available in a wide range of sizes, working pressures and capacities to fit the needs of gas producers and carriers.

It's a National®

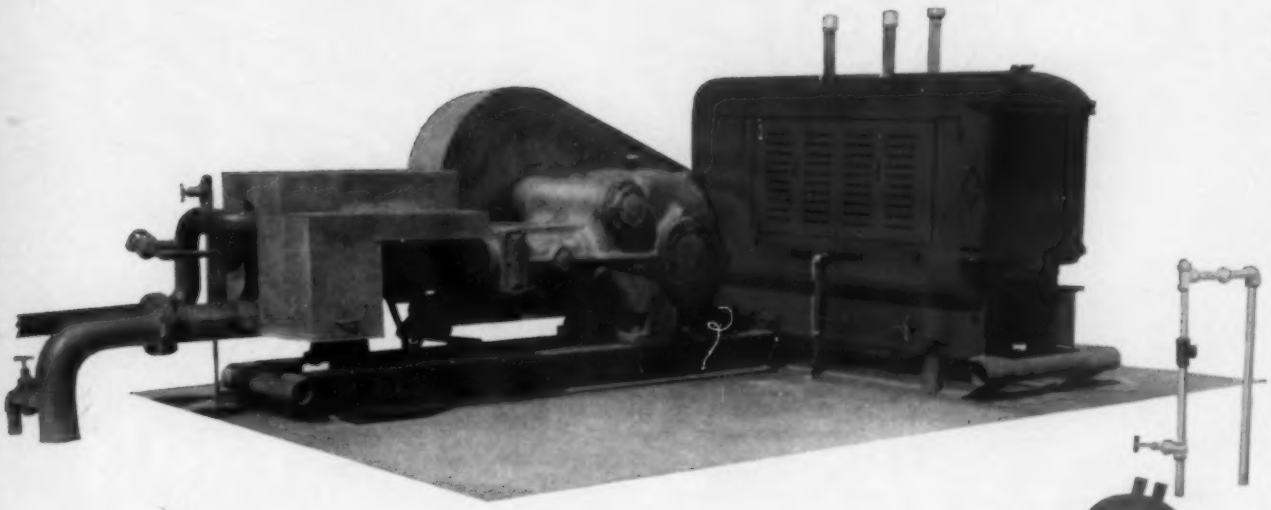
# NATIONAL TANK COMPANY

TULSA, OKLAHOMA

2-5-54

# Here's Why!

## ALLIS-CHALMERS ENGINES



## On Your Pipe Line Pumps Will Save You . . . $

Allis-Chalmers Engines deliver maximum power at moderate speeds—*reduces wear.* Pressure Lubrication to all internal parts at any speed—*reduces wear.* Heavy Blocks keep parts in proper alignment—*reduces wear.* Heavy Crank Shafts, Rods and Main Bearings — *reduces wear.* Ample Cooling—*reduces wear.* Mass production keeps parts *prices low.* Factory-fit Motor Kits easy to install—*keeps maintenance costs low.* Removable Cylinder Sleeves—*lowers maintenance costs.* Repairs can be made by any ordinary mechanic on the location—*keeps maintenance low.* Mass production keeps FIRST COST low.

**COMPARE**

1. Allis-Chalmers Quality
2. Allis-Chalmers First Cost
   Lower initial investment.
3. Allis-Chalmers Parts Cost
   Lower maintenance than any other engine

**FRED E. Cooper, Inc.**

P. O. BOX 1890 TULSA, OKLA.
Houston, Odessa, Los Angeles, Olney

# Specific steels

**YOUNGSTOWN**
*Electric Weld*
**LINE PIPE**

Uniformly satisfactory in service because—

Long lengths save time and trouble

Weldability is outstanding

It bends readily

Line up characteristics are excellent

## FOR TOP QUALITY PIPE

●All steel for Youngstown Electric Weld Pipe is of predetermined analysis—produced in the open hearth by closely controlled blending and refining of specially selected scrap, molten pig iron and high purity limestone. The result is uniform dependability.

Youngstown Electric Weld Pipe for the oil and gas industry is being made in sizes up to 22″ OD and in grades as high as X52. For further information, phone or write our nearest District Sales Office.

QUALITY YOUNGSTOWN SERVICE

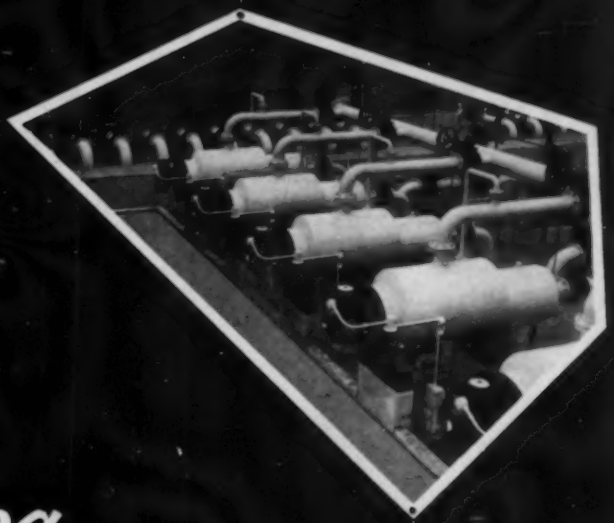
**Youngstown** ELECTRIC WELD LINE PIPE

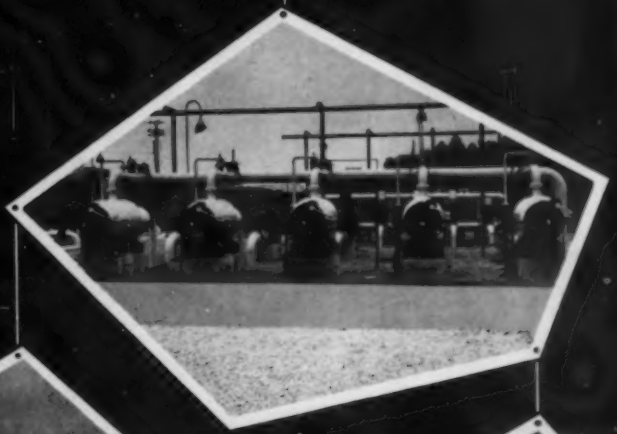
**THE YOUNGSTOWN SHEET AND TUBE COMPANY** *Manufacturers of Carbon, Alloy and Yoloy Steel*

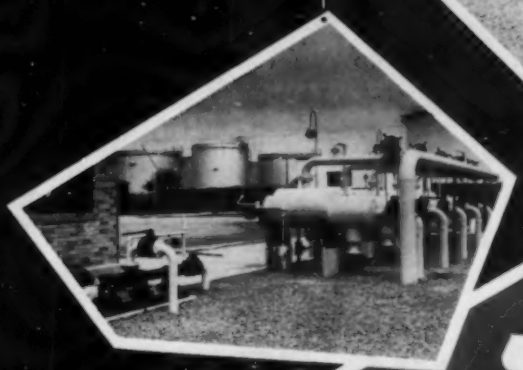
General Offices: Youngstown, Ohio - Export Office: 500 Fifth Avenue, New York 36, N. Y.

PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES

# there's a new angle on straining pipeline products







## JET TYPE

**self-cleaning pipeline strainers**

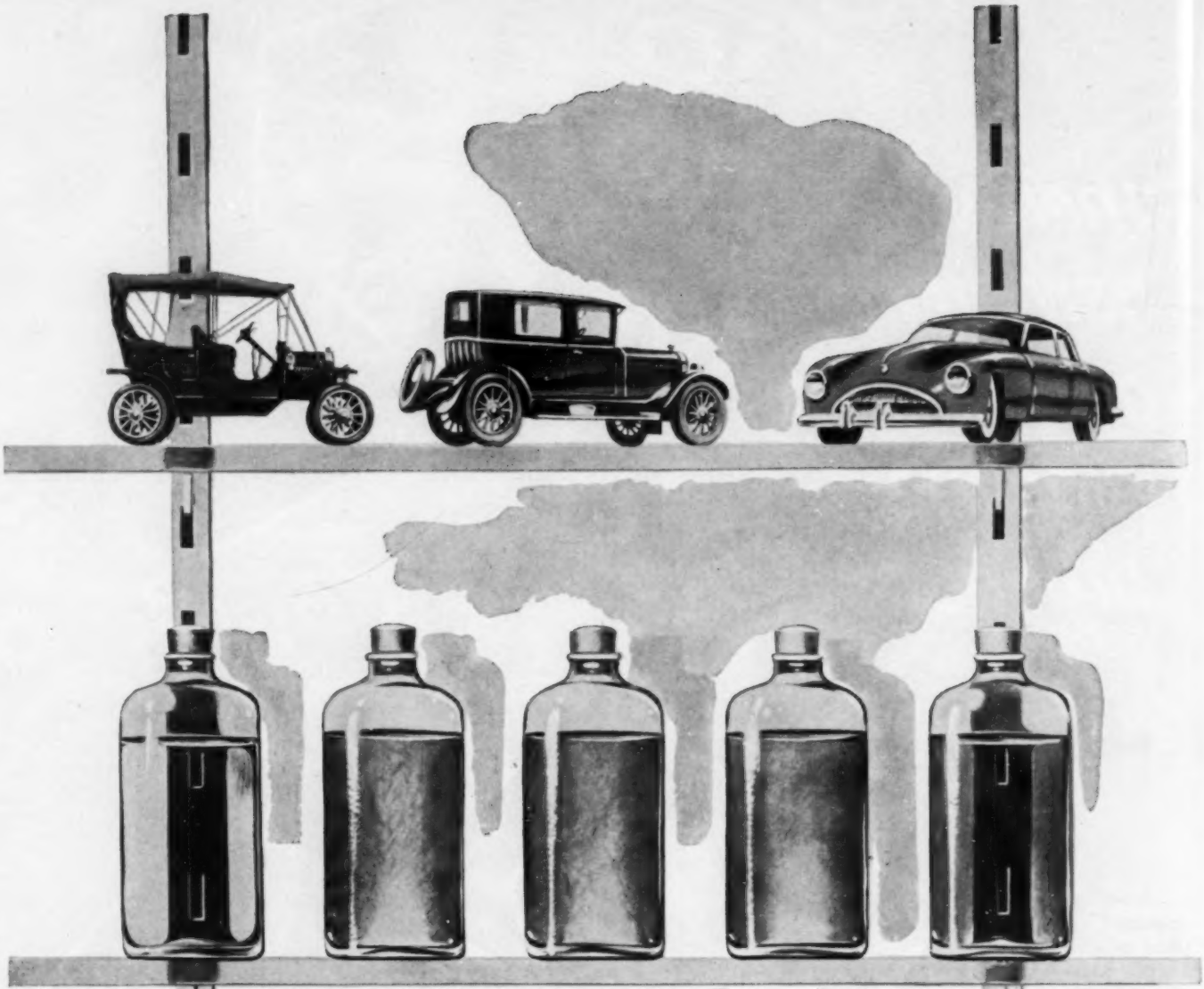
When strainers are needed most — a period of about 30 minutes while a scraper is being received — conventional strainers "blind" so quickly that they are of little benefit since they must be cleaned manually and time does not permit this operation. But Jet Type Strainers may be cleaned so rapidly that they can be returned to service **in a matter of minutes,** assuring a continuous flow of clean product through the meters or to storage. Bypassing is eliminated, consequently there is no damage to meters, pumps, seals, dehydrators, etc.

THORNHILL CRAVER CO.

P. O. BOX 1184 HOUSTON, TEXAS

Please send for Bulletin No. PL-540.

*"clean all of the product .... all the time"*



# what a change... in gasoline!

Some of the biggest changes in the constantly changing automotive field are the hardest to see—the changes in gasoline. Actually, there have been great improvements in gasoline over the years. Except for the introduction of tetraethyl lead in 1922, most of the changes have come through improved refining methods.

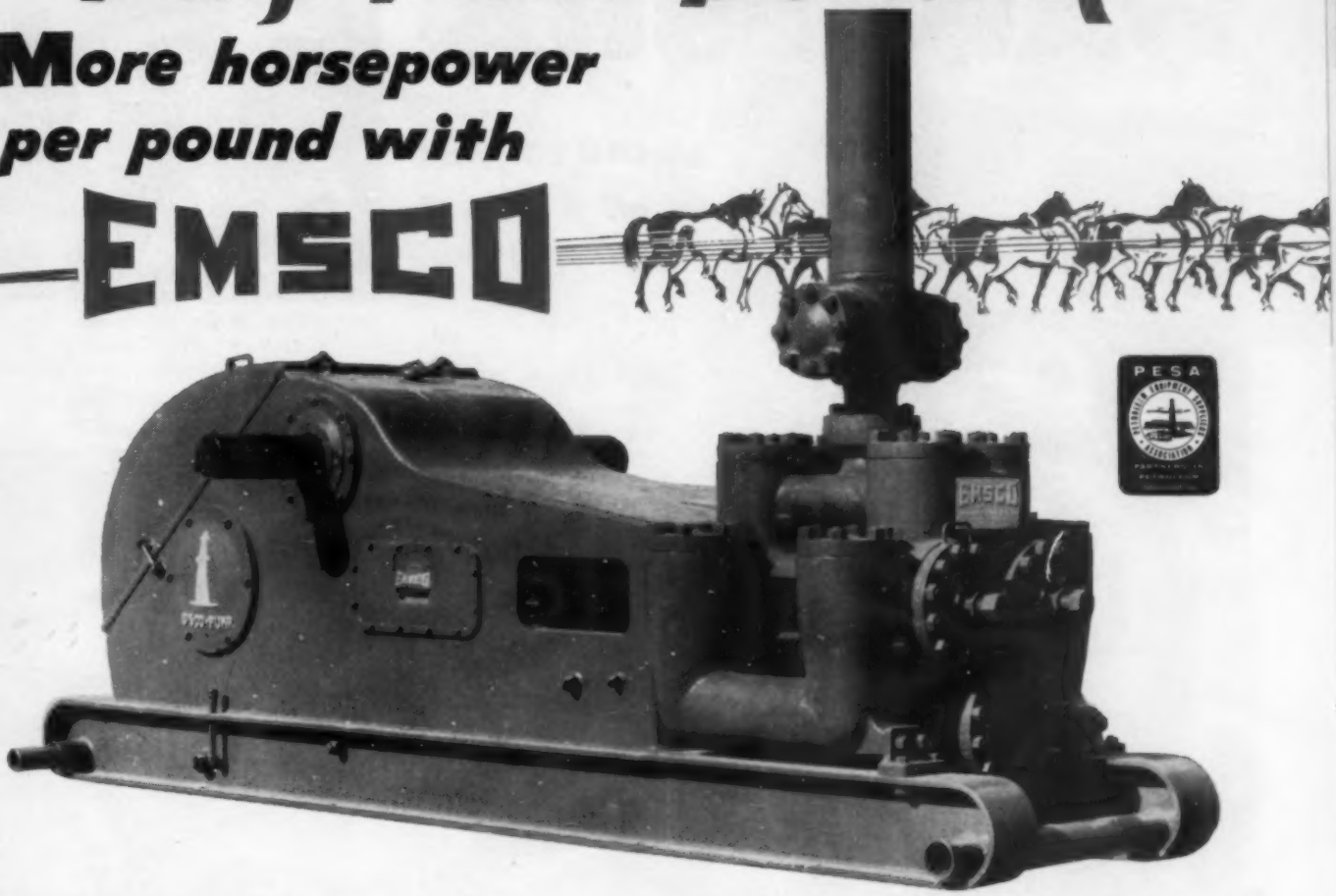
Shell Oil Company has been in the forefront of research to provide more efficient gasoline. One result of this effort is TCP, which has opened a new era in fuel improvement through the use of chemical additives. TCP is another example of how Shell research contributes to progress by being first with better petroleum products.

SHELL

**SHELL OIL COMPANY**

# "Buy From Bovaird"

## More horsepower per pound with EMSCO




Pound-for-pound your Emsco Power Slush Pump has more pumping capacity than any other pump on the market today. And it is more compact.

This means less weight and bulk to move from location to location . . . greater economy in transportation . . . and easier handling in transit or at the rig.

Emsco design and *fabriform* construction places metal exactly where it is needed to form a rigid, light-weight frame. It permits the use of *steel* plates and shapes in place of bulky, heavy iron castings.

In addition to lighter weight, you get these advantages: 1) Heavy-duty roller bearings throughout. 2) Heat treated forged steel herringbone gears. 3) Automatic lubrication. 4) Emsco's *exclusive* exposed liners that enable you to detect and correct liner packing leakage before damage is done.

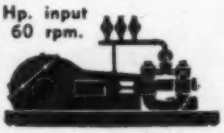
**EMSCO SERVICE** — Factory trained engineers, specializing in drilling problems, are available to help you keep your pumps operating at peak efficiency.

### OFFICES AND STORES

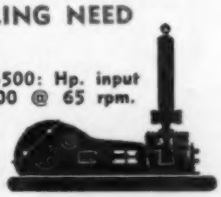
ILLINOIS — Clay City, Grayville, Salem
KANSAS — Chase, Great Bend, Liberal, Pratt, Russell, Wichita
NEW MEXICO — Lovington
OKLAHOMA — Duncan, Oklahoma City, Pauls Valley, Sapulpa, Seminole, Tulsa
TEXAS—Abilene, Borger, Dallas, Houston, Midland, Odessa, Pampa

### PUMPS TO MEET EVERY DRILLING NEED

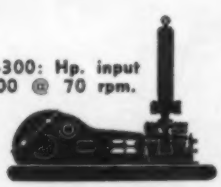
D-850: Hp. input 850 @ 60 rpm.



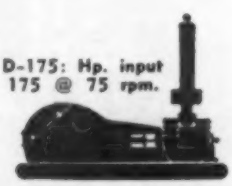
D-500: Hp. input 500 @ 65 rpm.



D-300: Hp. input 300 @ 70 rpm.



D-175: Hp. input 175 @ 75 rpm.

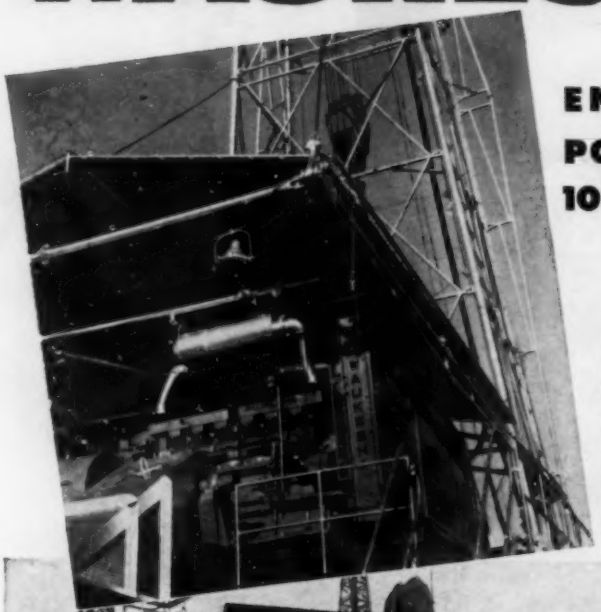


# THE Bovaird SUPPLY COMPANY

GENERAL OFFICES
TULSA, OKLAHOMA

83 YEARS OF PROGRESS WITH THE OIL INDUSTRY

# World's Finest Oil Field Power
# WAUKESHA

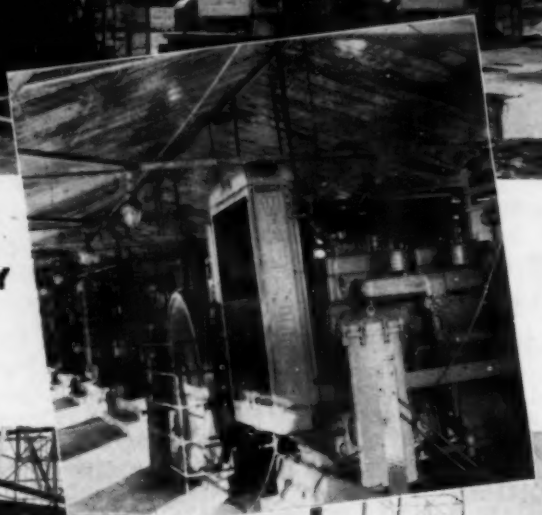


**ENGINES and POWER UNITS 10 hp. to 600 hp.**

*Send for*

**BULLETIN 1079**

It gives complete line of Waukesha Oil Field Engines for gas, gasoline, normal Diesel, or turbocharged Diesel operation—to 600 hp.



**WAUKESHA MOTOR COMPANY**

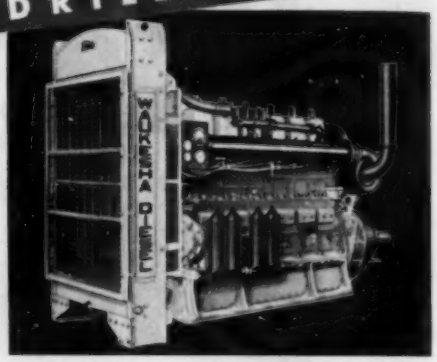
WAUKESHA, WISCONSIN

New York • Tulsa

Los Angeles

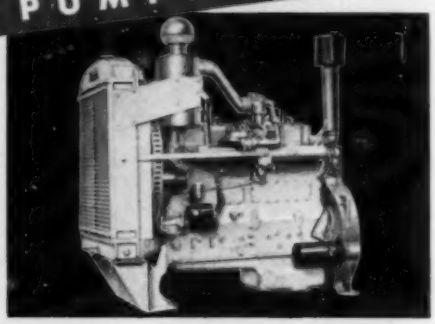
253

**DRILLING**



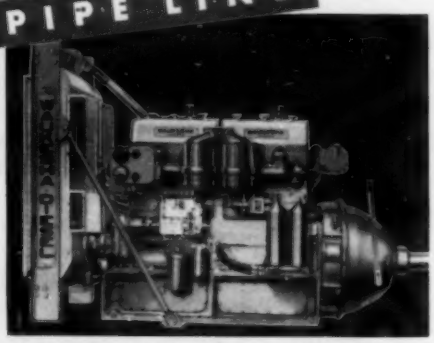
**LRDBSU Turbocharged Diesel Unit**—six cylinders, 8½-in. bore x 8½-in. stroke, 2894 cu. in. displacement, 526 hp at 1200 rpm, maximum.

**PUMPING**



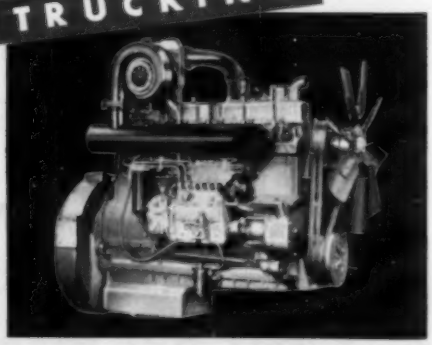
**145-GZBU Gas Power Unit**—six cylinders, 5⅜-in. bore x 6-in. stroke, 817 cu. in. displacement, 176 hp at 2000 rpm on natural gas.

**PIPE LINE**



**NKDBU Normal Diesel Power Unit**—six cylinders, 7-in. bore x 8¼-in. stroke, 1905 cu. in. displacement, 274 hp at 1200 rpm, maximum.

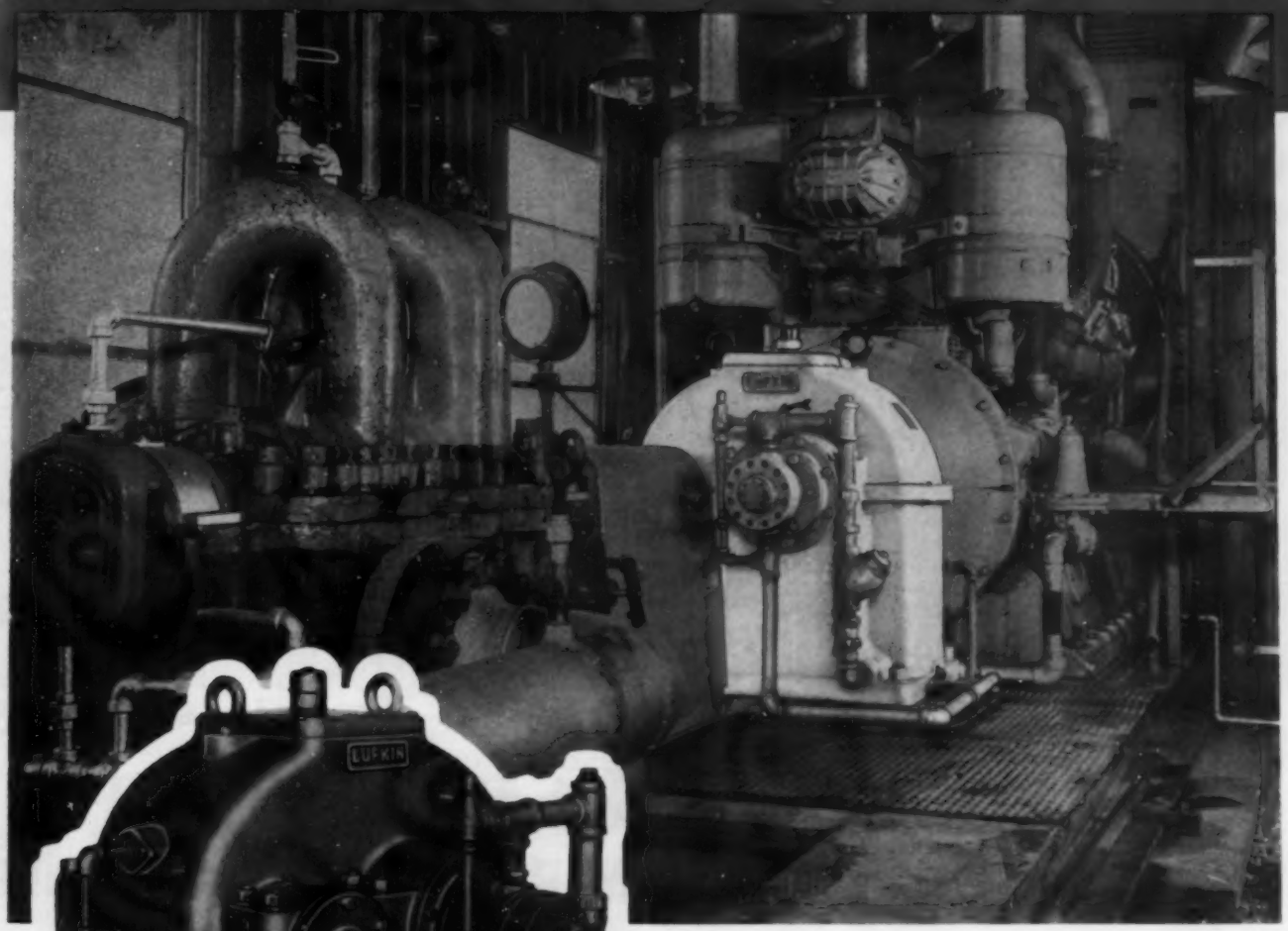
**TRUCKING**

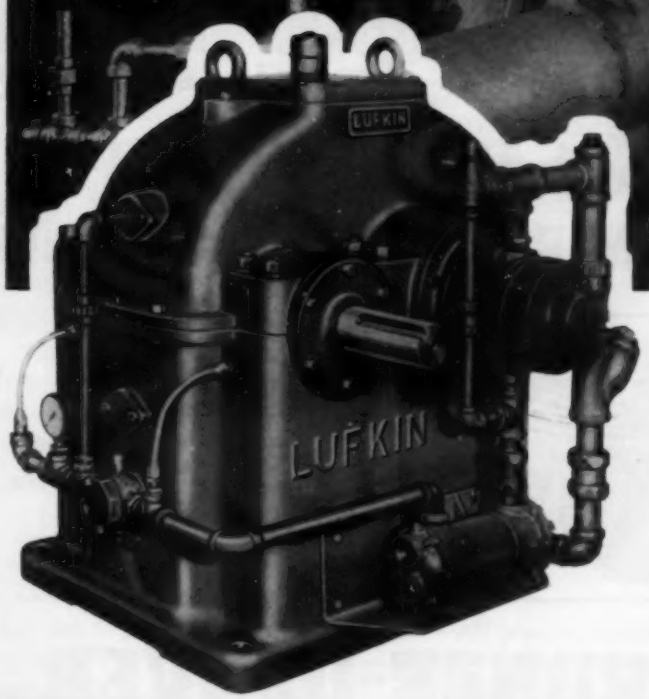


**148-DKBS Turbocharged Truck Diesel**—six cylinders, 5¼-in. bore x 6-in. stroke, 779 cu. in. displacement, 280 hp at 2100 rpm.

# LUFKIN Precision Gears

GUARANTEE THE UNINTERRUPTED TRANSMISSION OF POWER SO NECESSARY FOR THE UNINTERRUPTED TRANSMISSION OF OIL






HERRINGBONE GEARS GENERATED WITH EXTREME ACCURACY—RIGIDLY MOUNTED IN HEAVILY REINFORCED HOUSING—TO GIVE MANY YEARS OF QUIET, VIBRATIONLESS, TROUBLE-FREE OPERATION.

LUFKIN OFFERS A COMPLETE LINE OF SPEED INCREASERS FOR ALL TYPES OF PIPELINE SERVICE.

Lufkin FOUNDRY & MACHINE COMPANY

LUFKIN, TEXAS

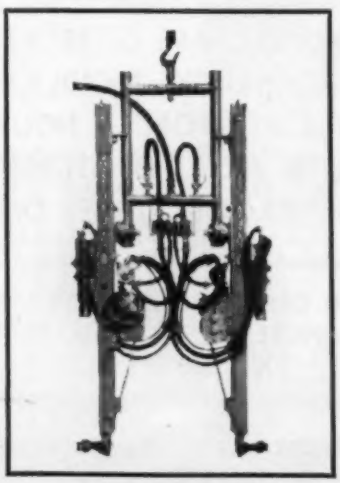
*Branch Sales and Service:* Houston • Dallas • New York • Tulsa • Los Angeles • Seminole • Oklahoma City • Corpus Christi • Odessa
Kilgore • Wichita Falls • Casper, Wyoming • Great Bend, Kansas • Effingham, Illinois • Duncan, Oklahoma
Brookhaven, Mississippi • El Dorado, Arkansas

Lufkin equipment in Canada is handled by THE LUFKIN MACHINE CO., LTD., 14321 108th Avenue, EDMONTON, ALBERTA, CANADA

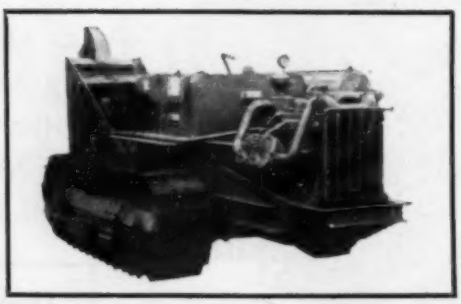
Gardner-Denver Twindril and Portable Compressor

# Rock?...Hit it Hard

## With Hard-Hitting GARDNER-DENVER Equipment



Gardner-Denver
Twindril ®



Gardner-Denver
Tractor-Mounted Compressor
for Operating Twindril
or Wagon Drills

SINCE 1859

**GARDNER-DENVER**

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS
FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

Gardner-Denver Company, Quincy, Illinois • In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

# Personal service—western style

HERE is what Kaiser Steel means to line pipe users in terms of personal service.

It means that you can get immediate, on-the-spot service from our full staff of trained metallurgists, technical men, production men, and sales personnel.

This personal attention to your needs—plus *uniform quality, on-time delivery* and *wide range of sizes*—is another reason why Kaiser Steel can best meet the needs of the area it serves.

**Kaiser Steel**

**KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications**

| Type | Diameter | Length | Wall Thickness | Shipping Point |
|---|---|---|---|---|
| Continuous Weld—Threaded and Coupled | ½" to 4" nominal I.D. | Uniform 21' | Standard | Fontana, Calif. |
| Continuous Weld—Plain End | 2⅜" to 4½" O.D. | Up to 40' | Standard | Fontana, Calif. |
| Electric Resistance and Fusion Weld—Plain End | 14" to 18" O.D. | Up to 40' | .250" to .500" | Napa, Calif.—Basalt-Kaiser |
| Electric Resistance Weld—Plain End | 5⅝" to 12¾" O.D. | Up to 55' | .188" to .375" | Fontana, Calif. |
| Electric Fusion Weld—Expanded—Plain End | 20" to 30" O.D. | Up to 40' | .250" to .500" | Napa, Calif.—Basalt-Kaiser |

**Prompt, dependable delivery at competitive prices • KAISER STEEL CORPORATION** Los Angeles, Oakland, Seattle, Portland, Phoenix, Denver, Tulsa, New York



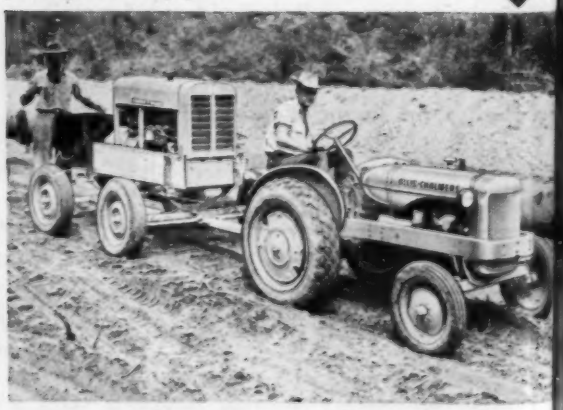
For more data on advertised products, use Readers' Service Cards, last page.

# Back your Bids

## with profit-making equipment

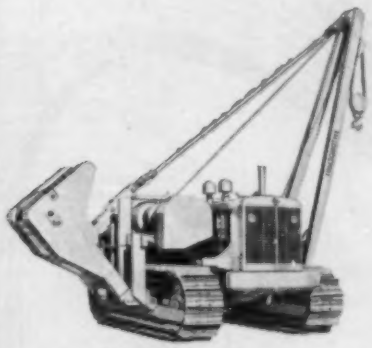
Allis-Chalmers HD-20 — 42,700 lb — 175 net engine hp — Hydraulic Torque Converter Drive

Wheel Tractors — Model IB for countless pushing, pulling, clean-up jobs

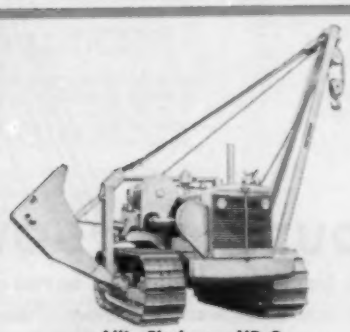


Allis-Chalmers HD-5G Tractor Shovel — Tractor Shovels available in 1¼ to 4-yd capacities

Pipe-line profit in terms of equipment boils down to two prime factors — the ability of the machines to provide big dirt-moving or pipe-handling output at a steady clip, and the willingness and ability of the dealer to give complete, time-saving service under all conditions. Here's how Allis-Chalmers meets the test:



Allis-Chalmers HD-15
Standard Transmission
109 drawbar hp — 29,500 lb
Optional Torque Converter Drive
135 net engine hp — 29,950 lb



Allis-Chalmers HD-9
72 drawbar hp — 19,600 lb
New Tractomotive Side Boom

Model AD-40 Motor Grader — Allis-Chalmers offers three diesel-powered models — 78 to 104 brake hp — and the 50 hp gasoline-powered Model D

Engines — Three sizes — for powering pipe cleaners and straighteners, compressors, generators, welders

## By any yardstick — the newest, the most advanced design equipment in the field.

Compare any Allis-Chalmers tractor feature by feature with any other tractor — compare balance, track design, lubrication, main frame, final drive . . . compare down time, serviceability, ease of overhaul . . . compare work speed, load capacity, ease of handling — compare any of a dozen points and you will see why these advanced design features bring you dependable, low-cost, high-production performance. Make the same check of Allis-Chalmers motor graders, Motor Scrapers, wheel tractors — see how all of these units are geared to today's punishing demands for speed, capacity, and strength.

### Dealer service — an all-out program

One big factor that has won over new customers — and keeps the old ones coming back — is the outstanding service rendered by Allis-Chalmers dealers. Customer reports from all over the country — both fleet owners and one-tractor operators — point up how Allis-Chalmers dealers go all out in providing fast and thorough service. You'll get solid backing with an Allis-Chalmers dealer on your pipe-line team.

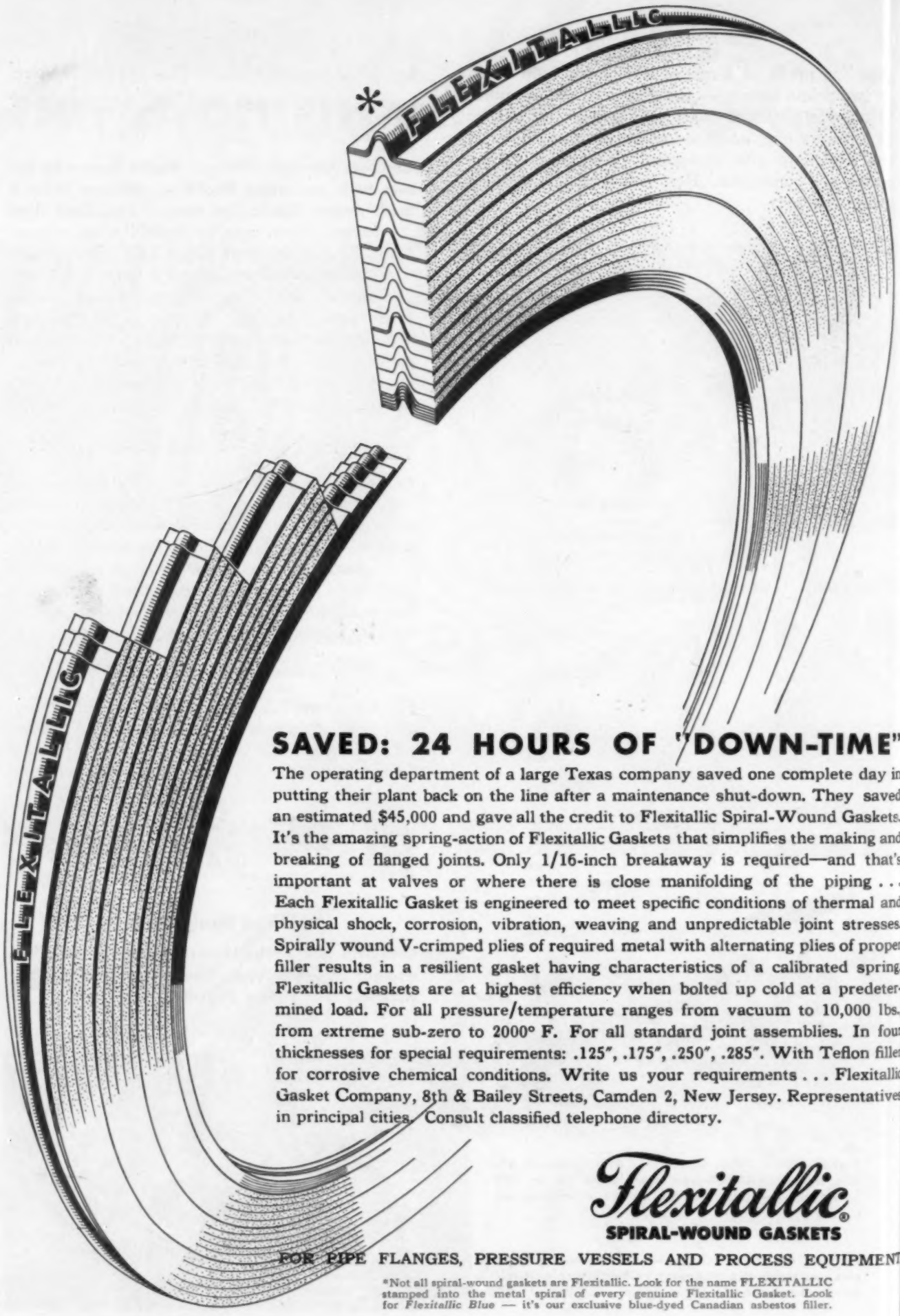
### Check the facts yourself

See for yourself how the newest in tractor-dozer-side boom equipment can speed output, cut costs on pipe-line operations. Your Allis-Chalmers dealer will be happy to arrange a demonstration on your own spread.

**ALLIS-CHALMERS**
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

### Allied Equipment

**Complete line of bulldozers, hydraulic or cable, straight or angle types, three side boom models, winches, four Tractor Shovels.**




## SAVED: 24 HOURS OF "DOWN-TIME"

The operating department of a large Texas company saved one complete day in putting their plant back on the line after a maintenance shut-down. They saved an estimated $45,000 and gave all the credit to Flexitallic Spiral-Wound Gaskets. It's the amazing spring-action of Flexitallic Gaskets that simplifies the making and breaking of flanged joints. Only 1/16-inch breakaway is required—and that's important at valves or where there is close manifolding of the piping . . . Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-crimped plies of required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 10,000 lbs., from extreme sub-zero to 2000° F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". With Teflon filler for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Company, 8th & Bailey Streets, Camden 2, New Jersey. Representatives in principal cities. Consult classified telephone directory.

**Flexitallic®**
**SPIRAL-WOUND GASKETS**

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Not all spiral-wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for *Flexitallic Blue* — it's our exclusive blue-dyed Canadian asbestos filler.

# WHO'S MEETING WHERE

| | |
|---|---|
| **NOV.** | |
| 4 | Midwest Industrial Gas Council, La Salle Hotel, Chicago. |
| 4 | NEGA Operation Division, Hotel Statler, Hartford, Conn. |
| 5 | SGA Field Production of Natural Gas Conference, Herring Hotel, Amarillo. |
| 8– 9 | Gas Measurement Institute, Legion Hall, Liberal, Kansas. |
| 8–11 | American Petroleum Institute, Conrad Hilton Hotel, Chicago. |
| 15–17 | American Standards Association, Hotel Roosevelt, New York. |
| 17 | NEGA Safety Conference, Hotel Statler, Boston. |
| 17–18 | North Texas Section, American Institute of Mining and Metallurgical Engineers, and Production Committee, of the North Texas Oil and Gas Association, Symposium on Secondary Recovery, Wichita Falls. |
| 17–19 | Southeastern Gas Association, Sir Walter Hotel, Raleigh, N. C. |
| 17–19 | Wisconsin Utilities Association, Electric and Gas Section, Technical and Sales and Service Divisions, Hotel Schroeder, Milwaukee |
| 18–19 | National Association of Corrosion Engineers, Fourth Annual Conference of Western Region, Hotel Biltmore, Los Angeles. |
| 28–Dec. 3 | American Society of Mechanical Engineers, Statler Hotel, New York. |
| **DEC.** | |
| 3 | American Society of Mechanical Engineers, Statler Hotel, New York. |
| 3 | Panhandle Plains Regional Meeting NGAA, Herring Hotel, Amarillo, Texas. |
| 6– 7 | SGA Advisory Council and Management Conference, Point Clear, Ala. |
| 7 | NEGA Appliance Servicing Conference, Hotel Statler, Boston. |
| 12–15 | American Institute of Chemical Engineers, Annual Meeting, Statler Hotel, New York. |
| **JAN. 1955** | |
| 17–19 | 7th Annual Convention, Pipe Line Contractors Association, Statler Hotel, Los Angeles. |
| 26–28 | Symposium on Instrumentation for Process Industries, A&M College of Texas, College Station, Texas. |
| 27–28 | American Chemical Society, Symposium on Hydrocarbon Chemistry, Rice Hotel, Houston. |

**Use the Readers' Service Cards in this Issue**

For more information on the advertised products in this issue, make use of the post card just inside the back cover. Circle on the post card the code number of the item desired. Your request will be forwarded to the manufacturer and the material will be mailed directly to you. Use the post card also to obtain material on the new equipment and literature items reviewed in this issue by circling the editorial code numbers at the top of the post card.

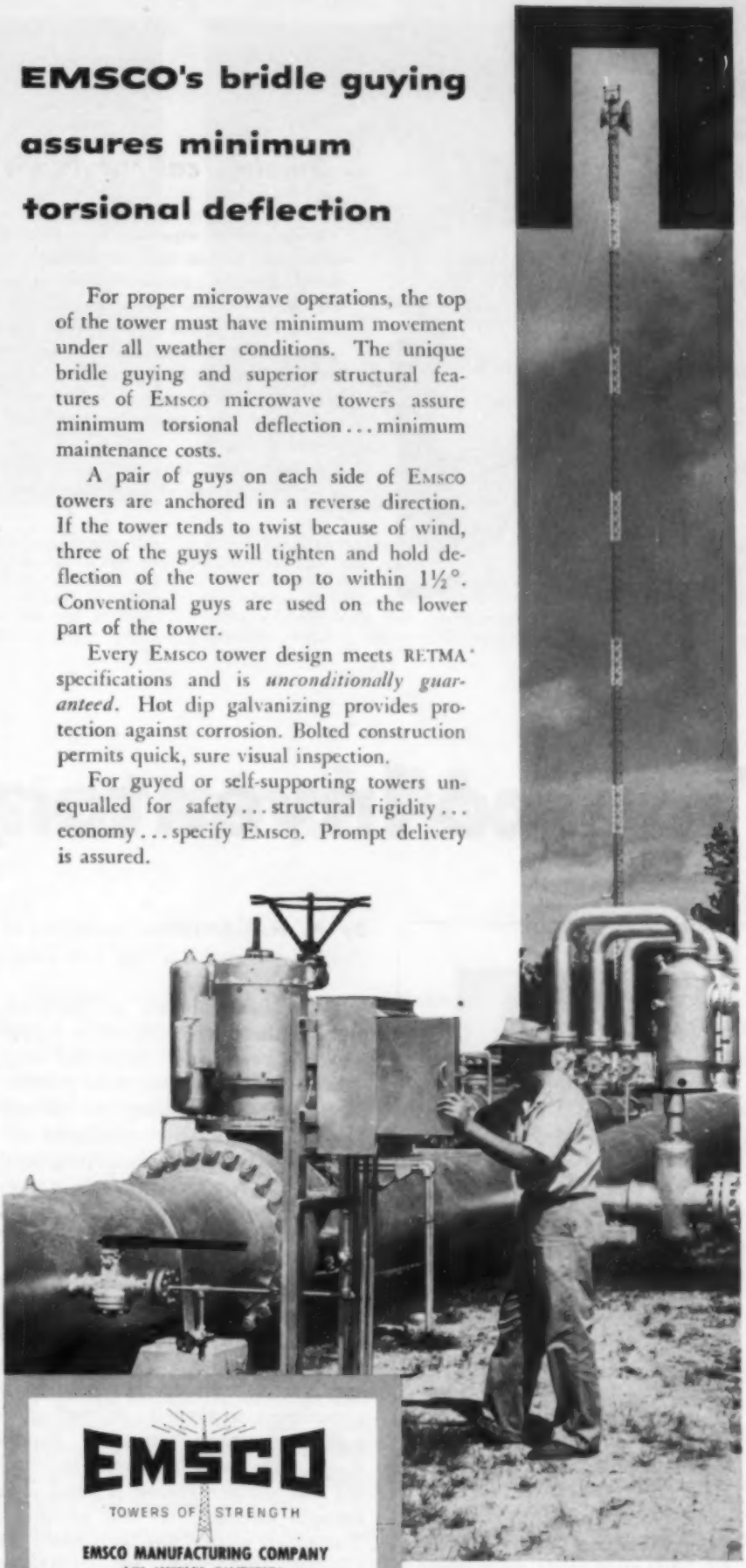

## EMSCO's bridle guying assures minimum torsional deflection

For proper microwave operations, the top of the tower must have minimum movement under all weather conditions. The unique bridle guying and superior structural features of Emsco microwave towers assure minimum torsional deflection... minimum maintenance costs.

A pair of guys on each side of Emsco towers are anchored in a reverse direction. If the tower tends to twist because of wind, three of the guys will tighten and hold deflection of the tower top to within 1½°. Conventional guys are used on the lower part of the tower.

Every Emsco tower design meets RETMA specifications and is *unconditionally guaranteed*. Hot dip galvanizing provides protection against corrosion. Bolted construction permits quick, sure visual inspection.

For guyed or self-supporting towers unequalled for safety... structural rigidity... economy... specify Emsco. Prompt delivery is assured.



EMSCO

TOWERS OF STRENGTH

EMSCO MANUFACTURING COMPANY

LOS ANGELES, CALIFORNIA

Houston, Texas · Garland, Texas

*Typical Emsco microwave installation Barton, Alabama*

E-184

### *A hurried call at night . . .*

**Every station superintendent of a compressor or pump station has made an emergency call at night to locate a vital part for a compressor, engine, pump, electrical switch gear, etc. Failure to get the part immediately may mean that pipe line deliveries may have to be cut back. And more often than not, the needed part can be found in one of the station warehouses somewhere along the line.**

**For Transco station superintendents this sometimes difficult task is a breeze. A phone call to one of Transco's stores accounting men in Houston—even at night—and he'll have the answer in five minutes. The reason is that every gasket, bolt, nut, piston, etc. (regardless of cost) is catalogued in the store's accounting Summary Report.**

**Transco's Sour Lake compressor station superintendent Arlie Gadman is shown at left making one of these emergency calls.**

# Transco Inventory System

A. H. CANNON, a native of Norfolk, Va., attended the William and Mary extension program there for two years. Later he studied accounting at night school for five years at the V.P.I. extension program in Richmond. He spent 21 years with the Virginia Electric and Power Company where he was chief clerk for the purchasing and stores department before he joined Transco in 1950.

**By A. H. CANNON,** Supervisor of Stores,
Transcontinental Gas Pipe Line Corporation, Houston

THAT ASSET known as Materials and Supplies—have you taken a good look at it recently? It is the asset which usually takes the third position on the left hand side of the balance sheet. Sometimes it is small and appears insignificant when compared with the company's property investment, yet, many times it is large, actually exceeding in total value the most current of all assets—cash.

Everyone knows the protection and care that is given to cash. It is safely guarded, always protected, checked and double checked. Yet, with all the care given cash, current position is sometimes weakened through improper inventory controls. Simply stated, you have been over-purchasing but do not realize it until it is brought forceably to your attention. Too much money has been spent for materials and supplies for which there is no current need. Some materials may be becoming obsolete. Some materials may be in rapid process of deterioration and prices may be failing. You look around seeking means of using or disposing of the surplus. Usually these efforts prove unfruitful and so, in desperation, you sell. Not at one hundred cents on the dollar of the amount you paid, however, but at amounts far below jobbers' prices, and too often even at scrap prices.

Stock represents cash and it must be treated as such. It demands the same attention as cash, the "number one" asset. We blame our stores accounting system for the inventory that went awry. How did it and how could it have happened? We realize our responsibility, so we try to devise a control system of buying, a system that will keep us up to date. We call in the experts and ask for their recommendations. We seek an answer, but unless we know what we are seeking, we may find we are operating our stores departments in the same way they were operated in the day of the Pharoahs when Joseph acted as store-

**RECURRING REQUISITION SAVES TIME** in ordering materials kept in stock at the station. Here, Station Clerk George Owens checks a part against the card at the Transco Sour Lake warehouse. When an individual item hits the minimum the clerk prepares and sends the recurring requisition to the Houston office. Less than one third of Owens' time is devoted to stores.

**RECURRING REQUISITIONS CARD TESTED** in Transco's Houston office against stock records by Material Control Clerk F. J. Struben, Jr. If needed material is in surplus anywhere on the system, the requisition is returned with the notice that shipment is being made from another location. If the material is not available, the requisition is forwarded to Purchasing department.

# Saves Time and Money

keeper for the granaries. It isn't always a new system that is needed, however. It is possible that the history contained in the records is simply being overlooked. Careful analysis of the historical record of materials is a prime necessity when establishing inventory control.

**Inventor + Purchases — Disbursement = Inventory**

Stores is operated on the simple formula or equation—beginning inventory, plus purchases, less disbursements, equals ending inventory.

**Transco uses tabulating equipment for the control of stores.** There are just as many different methods and approaches to Stores through tabulating equipment control as there are to any other approach to the problem of establishing a Stores control system. You and I must know the information we need and, furthermore, such information must be available when needed.

Material control in Transcontinental functions from the central office in Houston and stock records or quantity records are not maintained at the field offices. Eight employes, including the supervisor of stores and a stenographer, make up the Stores Accounting Section. Their requisites are a definite knowledge of materials and a general understanding of material accounting.

There are 31 storerooms in the system, all approximately 60 miles apart, from Texas to New Jersey. Nineteen of these are compressor station storerooms and 12 are pipe line storerooms. The average dollar value of stock carried at each compressor storeroom amounts to approximately $50,000 and at each pipe line storeroom approximately $200,000.

**Transco has no full-time field employes maintaining the material and supply inventory.** It has been found that in each location the compressor station or pipe line department clerks have ample time to take care of the stores work as well as other necessary clerical duties, such as payroll, working funds, etc. These clerks are not required to keep field stock records and, as a result, the necessity for a full-time storekeeper has been eliminated.

In devising and perfecting any system, the personnel available to operate the system must be taken into consideration. It is difficult to obtain a sufficient number of experienced personnel who have both a knowledge of the materials to be controlled in a company and the accounting experience necessary for the maintenance of adequate materials and supplies records. In order to compensate for a lack of experience and training it is necessary to develop a system which will provide essential information and controls and at the same time be easily understood by all personnel.

**FROM THE REQUISITION,** Assistant Purchasing Agent R. E. Sledge places a verbal order with a manufacturer. The purchase order is typed up on duplicating material and sufficient copies are made to include receiving reports and other forms for departments needing them. This, too, saves time and money.

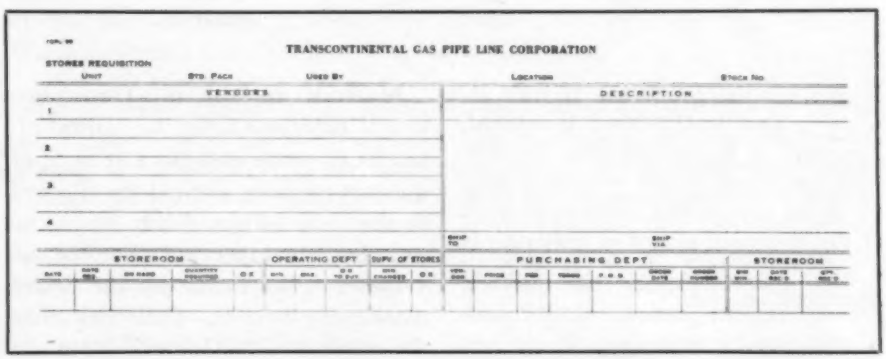
**WHEN THE MATERIAL IS RECEIVED** in the field, it is checked against the recurring card and labeled with the company stock number so that the parts can be identified and checked out when needed. Checking this incoming shipment at the Sour Lake station is Repair Foreman E. T. George.

## The stock or code number

**17 225360**

The fundamental principle of the Stores system established in Transcontinental is the coding of all stock items. This involves the assignment of a stock number to each item of material carried in stock. The first two digits of these six-digit stock numbers denote major groups or types of material involved. For instance, group 01 means pipe, group 03 means pipe fittings, group 42 means lubricators, etc. The last four digits are assigned to identify different items of stock within each of the major groups. With a four-digit item number, it is possible to separately identify 9999 different stock items in each of the 99 possible major groups or types of materials and supplies.

This coding system has proven flexible enough to allow for expansion whenever it is necessary for the Stores Accounting section to assign a distinctive number to a new item purchased for stock. In addition to this assignment of a code number to the material, it also is necessary to assign a code number to each storeroom location. This number is for identification on all documents processed and handled involving stock items and for purposes of providing separate reporting and controls for each location.



TRANSCONTINENTAL GAS PIPE LINE CORPORATION

STORES REQUISITION

Unit | Std. Pack | Used By | Location | Stock No.

VENDORS | DESCRIPTION

1
2
3
4

Ship To | Ship Via

STOREROOM | OPERATING DEPT. | SUPV. OF STORES | PURCHASING DEPT. | STOREROOM

Date | Date Req. | On Hand | Quantity Required | O.K. | Date | Date Req. | Qty. to Buy | Quantity Ordered | O.K. | Vendor Code | Price | F.O.B. | Terms | F.O.B. | Order Date | Order Number | Qty. | Date Rec'd | Qty. Rec'd

**RECURRING-TYPE REQUISITION**

## Two types requisitions used

Transcontinental uses two distinct types of purchase requisitions in ordering materials. A recurring type requisition on card stock is used in ordering materials to be carried in the Materials and Supplies account. A multi-copy requisition on paper stock is used in ordering all other non-stock materials, supplies and equipment. The recurring requisition remains at each storeroom until such time as additional material is needed and is the only basic record provided at any field location. This requisition contains a full and complete description of a particular stock item and the code number assigned to that item. Each requisition can be used for 12 separate orders of an item and, if tumble-headed or printed on the back, it may be used for 24 separate orders of the item.

***Invoice checked . . . paid***

**THE MATERIAL HAS BEEN RECEIVED** in the field and R. Garrow Wessendorff of the Accounts Payable section checks the receiving copy of the purchase order with the vendor's invoice. If there are no errors or changes, he sends the invoice on for payment.

**ON THE BASIS OF THE RECEIVING REPORT** and the testing of the report against the invoice, accounting clerk Launa Oliphant prepares the necessary check for payment of the invoice, a copy of which is included in the voucher file that is forwarded to the tabulating section for inclusion in the tabulated inventory run.

## Inventory control

A maximum and a minimum figure have been established for each item of material carried in stock based upon the actual and/or anticipated use of that item. When it is necessary to reorder an item, the applicable recurring requisition is removed from file and reprocessed by entering appropriate information in the spaces provided on the next line of the requisition form.

This information includes an entry for the actual quantity on hand in stock. The recurring requisition is then forwarded to the Stores Accounting Section in the Houston office where the order is reviewed and approval of the department using the material is obtained.

At this point there are applied important inventory control practices for, regardless of the item ordered, whether a stock item on a recurring requisition, or a non-stock item ordered on a regular one-time purchase requisition, it is subjected to stock control tests in the Stores Accounting Section. The tests applied are to determine if the material can be furnished from another, overstocked location, if there is a suitable substitute in stock, if a minimum and maximum have been established for the item and if the order is within those established limits.

In addition to the control accomplished by clearing all purchase requisitions through the Stores Accounting section, personnel of the Engineering department check with the Stores Accounting section as to the availability of materials in stock prior to the requisitioning of materials for construction purposes. For the purposes of this check, the Engineering department furnishes Stores Accounting with a list of the materials required, the specifications desired and the date such materials should be at the job site.

These important initial inventory control measures can best be performed in the Stores Accounting section for the reason that, by being continually in touch with the stock situation throughout the system, those people are in the best position to know what is available in the system, what is already on order and whether or not to offer a substitute.

If a purchase requisition satisfactorily meets all of the tests and the material requisitioned is to be purchased, the requisition then is passed along to the Purchasing department where the material is ordered. In the case of recurring stock requisitions, the Purchasing department enters the pertinent ordering data thereon and then returns them to their various points of origin along with copies of the related purchase orders.

At Transcontinental, a copy of each purchase order is designed to serve as the receiving report for the material ordered thereon and is sent to the receiving destination. When the material has been received at the receiving destination, this material receiving report copy of the purchase order is completed and forwarded to the Houston office. Based upon this report, the invoice is cleared for payment and they move together into the Tabulating department where the pertinent details become a part of the inventory records.

## Removal of stock from storerooms

If cash were removed from the cash drawer, it would be normal procedure in accounting for it to state the reason for such removal. The same pro-

***The information goes on a punch card and comes out on . . .***

**FROM THE VOUCHER** which includes the manufacturer's invoice and the receiving report, Ann Courtin, key punch operator, prepares a punch card which includes location number, stock number of item received, quantity and its value. These cards are prepared at the rate of 10 per minute.

**THE NEW CARDS ARE PROPERLY COLLATED** to the basic store's balance cards from which a new balance is established. A month ending run of each item carried in stock is being prepared by Russell Smith, senior tabulating operator. These are the runs that are distributed to the field.

cedure is equally applicable to materials removed from the storeroom. How much was removed and for what reason? For the purpose of recording these removals from stock, Transcontinental uses a very simple form of stock issue, or disbursement slip. On this form, space is provided for recording the stock numbers of items removed from stock, the quantities removed and a brief description of the items themselves.

The form also makes provision for a description of the purpose for which the material was removed and for the code or account number to which the stock cost is to be charged—to plant account, to operation or maintenance expenses, or to other accounts. This stock issue form, when properly approved, becomes the authority for issuance of the material.

When the material has been issued and the stock issue form is in order, it is forwarded by the field operating department clerk to the Stores Accounting section in the Houston office. There it is checked for proper stock number and forwarded to the Classification section of the General Accounting department. After it has been checked for classification, the form is forwarded on to the Tabulating department for inclusion in the detailed records of materials and supplies.

## Accurate records are essential

The Stores control functions performed by the Tabulating department in the Transcontinental system are (1) the recording of all transactions involving purchases, issues, returns or transfers of stock items, (2) the determination of unit and dollar balances and (3) the preparation of records and reports necessary for the effective management of the Stores activity.

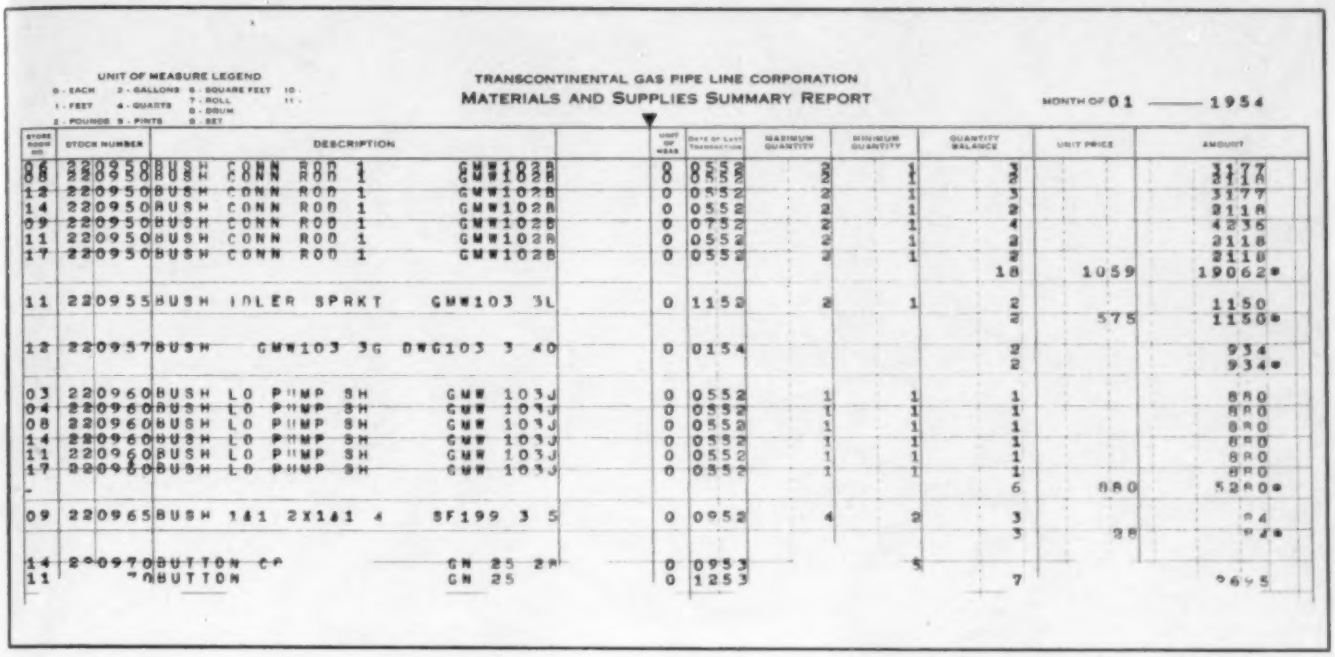
This is an important part of the system which has been planned to protect the company's investment in materials and supplies and to insure that materials and spare parts will be on hand where and when they are needed to maintain around-the-clock gas transmission service to customers.

The Stores man must know what he has available, he must be able to anticipate what will be needed for emergencies and he must know what is required to preserve and maintain all operating equipment. He needs a simple, historical record which will furnish this vital information.

Before Transcontinental's Stores records were converted to a tabulating process, considerable thought was given to the development of a system which would meet the most urgent needs without being too cumbersome or complex. In addition to accounting for stock transactions, we needed to determine whether the system could be so designed as to provide effective control of the inventory and to furnish information quickly for locating an item anywhere in the system.

The first step in developing the system was the design of a punch card which would reflect the location, stock number, description, opening balance, average unit cost and stock value for each item at each of the stock locations. This is the basic card by which all Stores transactions are recorded and from which all Stores reports are prepared.

At the end of each month, after all stock transactions for the month have been recorded, a summary report of the materials in stock is prepared and



UNIT OF MEASURE LEGEND
0 - EACH 2 - GALLONS 6 - SQUARE FEET 10 -
1 - FEET 4 - QUARTS 7 - ROLL 11 -
3 - POUNDS 5 - PINTS 8 - DRUM 9 - SET

TRANSCONTINENTAL GAS PIPE LINE CORPORATION
MATERIALS AND SUPPLIES SUMMARY REPORT

MONTH OF 01 —— 1954

| STORE ROOM NO. | STOCK NUMBER | DESCRIPTION | UNIT OF MEAS. | DATE OF LAST TRANSACTION | MAXIMUM QUANTITY | MINIMUM QUANTITY | QUANTITY BALANCE | UNIT PRICE | AMOUNT |
|---|---|---|---|---|---|---|---|---|---|
| 06 | 220950 | BUSH CONN ROD 1 GMW102B | 0 | 0552 | 2 | 1 | 3 | | 3177 |
| 08 | 220950 | BUSH CONN ROD 1 GMW102B | 0 | 0552 | 2 | 1 | 2 | | 2118 |
| 12 | 220950 | BUSH CONN ROD 1 GMW102B | 0 | 0552 | 2 | 1 | 3 | | 3177 |
| 14 | 220950 | BUSH CONN ROD 1 GMW102B | 0 | 0552 | 2 | 1 | 2 | | 2118 |
| 09 | 220950 | BUSH CONN ROD 1 GMW102B | 0 | 0752 | 2 | 1 | 4 | | 4236 |
| 11 | 220950 | BUSH CONN ROD 1 GMW102B | 0 | 0552 | 2 | 1 | 2 | | 2118 |
| 17 | 220950 | BUSH CONN ROD 1 GMW102B | 0 | 0552 | 2 | 1 | 2 | | 2118 |
| | | | | | | | 18 | 1059 | 19062* |
| 11 | 220955 | BUSH IDLER SPRKT GMW103 3L | 0 | 1152 | 2 | 1 | 2 | | 1150 |
| | | | | | | | 2 | 575 | 1150* |
| 12 | 220957 | BUSH GMW103 3G DWG103 3 40 | 0 | 0154 | | | 2 | | 934 |
| | | | | | | | 2 | | 934* |
| 03 | 220960 | BUSH LO PUMP SH GMW 103J | 0 | 0552 | 1 | 1 | 1 | | 880 |
| 04 | 220960 | BUSH LO PUMP SH GMW 103J | 0 | 0552 | 1 | 1 | 1 | | 880 |
| 08 | 220960 | BUSH LO PUMP SH GMW 103J | 0 | 0552 | 1 | 1 | 1 | | 880 |
| 14 | 220960 | BUSH LO PUMP SH GMW 103J | 0 | 0552 | 1 | 1 | 1 | | 880 |
| 11 | 220960 | BUSH LO PUMP SH GMW 103J | 0 | 0552 | 1 | 1 | 1 | | 880 |
| 17 | 220960 | BUSH LO PUMP SH GMW 103J | 0 | 0552 | 1 | 1 | 1 | | 880 |
| | | | | | | | 6 | 880 | 5280* |
| 09 | 220965 | BUSH 1&1 2X1&1 4 SF199 3 5 | 0 | 0952 | 4 | 2 | 3 | | 84 |
| | | | | | | | 3 | 28 | 84* |
| 14 | 220970 | BUTTON CP GN 25 2P | 0 | 0953 | | 5 | | | |
| 11 | | BUTTON GN 25 | 0 | 1253 | | | 7 | | 9695 |

furnished to Stores Accounting section for review and distribution. This particluar summary report is prepared in stockroom location order. In addition to showing the items of stock on hand at each location, it also carries the maximum and minimum quantities established and reflects the date of the last transaction with respect to each item in stock.

One copy of the summary report for each storeroom location is retained in the Stores Accounting section and another copy is sent to that location. These tabulated reports are easily analyzed and the items which are outside the limitations of the established maximums and minimums may be readily spotted. By sending a copy of the summary report to each storeroom location, the local operating personnel can keep completely familiar with their stock situation and be in a better position to assist in controlling their own stock inventories.

In addition to this monthly summary report, an additional tabulated report is prepared monthly and furnished to the Stores Accounting section. This report is a recapitulation of stock at all locations throughout the system and is prepared in numerical sequence by stock item number. This report provides a ready reference for determining the location of any needed item as well as its availability.

Although any effective Stores system has as its primary objective the control of materials and supplies inventories, it does not necessarily follow that such control means only reduction of stock. Certainly, it does not mean reducing stock to a point which could tie up production or otherwise interfere with system operations.

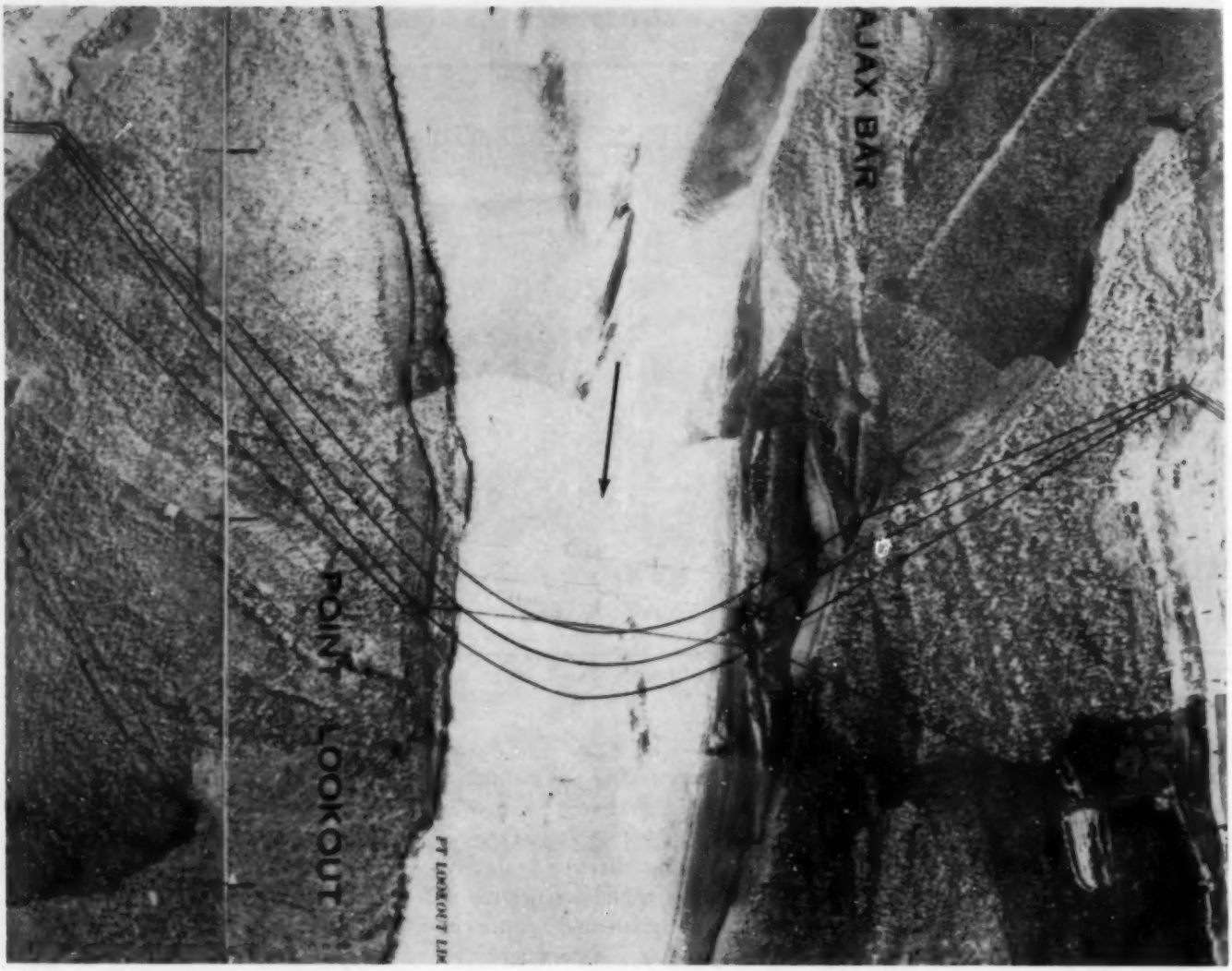
It must be recognized that the lack of a single part can stop an engine so that system performance is curtailed. Through proper inventory control measures, this "down-time," or loss of performance, can be held to a minimum.

If an emergency call for a needed part comes in the middle of the night, it is extremely important to the company, and of considerable satisfaction to the Stores man to be able to refer to this system-wide report and say that there is one of the parts available at another storeroom location nearby and that it will be on its way by truck or plane within a very few minutes.

This briefly is the Stores Accounting system at Transcontinental. It is not elaborate or difficult to understand and it does the job for which it was designed. Transcontinental is a transmission company and, as a result, most of the inventory items are relatively inactive and are carried in stock only to take care of contingencies. This system is sufficiently flexible that, if the reported information were needed more often than once each month for proper control, the Tabulating department could furnish activity reports on a daily, weekly or bi-weekly basis reflecting only those items which have been increased or decreased by current transactions.

There are likely as many different approaches to Stores control as there are companies with inventories. Each company may feel that its own system best meets the needs under its particular circumstances. The system used in Transcontinental is certainly not unusual. It was designed especially to fit the particular circumstances under which the company operates its natural gas transmission system through a 12-state area and it has continued to satisfactorily meet the tests of experience year after year.

Stores inventories represent valuable investments—they should be protected. —**The End**




**THREE CROSSINGS LAID IN CATENARY** downstream in the Mississippi River, following route shown in this aerial photograph. Arkansas is on the left; Mississippi on the right. The three 18-inch lines are 100 feet apart in the river.

# TGT Crosses the Mississippi Again

**Three 18-inch lines were laid in catenary downstream. Wall thickness of more than one inch eliminated the need of weights and special coatings. The pipe simply lies on the bottom in the center of the river.**

**By C. B. PORTER,** Tennessee Gas Transmission Company, Houston

TENNESSEE GAS TRANSMISSION COMPANY has completed its third multi-line crossing of the Mississippi River. This new crossing consists of three 18-inch lines with 1⅛ inch wall thickness. The lines are laid in a downstream loop in the bed of the river.

On either shore, the three lines tie into the company's new 30-inch, 576-mile line that runs from the Kinder, La., compressor station to the Portland, Tenn., station. In effect, this new pipe line gives Tennessee Gas a five-line system running to western Kentucky. Moreover, it gives the company a direct connection for moving gas from south Louisiana and offshore locations in the Gulf of Mexico to eastern markets.

The Mississippi River is many things to many people. In the early history of our country it played an important part in the development of the West. It was an important artery of commerce long before natural gas was widely used as a fuel.

But to pipeliners, the Mississippi is one of the most difficult obstacles encountered in running lines to the East.

The river's currents, the rains, heat and terrain must be overcome in laying a line across it. **And for the cost of the one mile crossing, 25 miles of 30-inch pipe line could be laid in normal terrain.**

**GIGANTIC CUT** on the Arkansas side of the river. Note that the lay barge at lower left is starting the line out into the river.

**Preliminary preparations** consumed more time than the actual laying of the line. First, the river had to be surveyed to find a suitable crossing. Conferences were held with the Corps of Engineers to study the difficulties that might be encountered from scouring and channel-shifting. The cost of an underwater crossing was compared with the cost of building a bridge to carry the lines. (It was estimated that the multiple-line underwater crossing would cost less than 50 percent of the cost of a bridge.) Soundings were made at several prospective locations, and with such information at hand, a point 6.5 miles southeast of Lake Providence, La., and 473 miles above Head of Passes was chosen. Then the job of land and right-of-way acquisition was started. In the meantime bids were taken and a contractor selected. Dredges, barges and other machinery were moved onto location.

At last the job was ready to start. But much work still had to be done to prepare the site for pipe laying. Right-of-way had to be cleared on the approaches to the river, and several hundred thousand yards of sand had to be moved to prepare the way for the pipe at the river's edge. Two eight-yard drag lines were used for the latter task.

**Dredging.** To prepare a ditch for the pipe, an estimated 3 million cubic yards of earth had to be dredged. This is equivalent to the cubic content of the Empire State building. The finished ditch was 200 feet wide at the bottom, leaving room for the three lines to be spaced 100 feet apart. The depth of the cut varies from 80 feet at the west bank to zero at the center of the main channel. When the lines were laid in their final resting place they were from 2 to 4 feet below sea level.

To do this work, the contractor moved in the George W. Catt, a 27-inch dredge with a hull length of 170 feet and a 38-foot beam. The over-all length from ladder to stern is 212 feet. The dredge's main pump, driven by a 4000 horsepower steam turbine, is capable of pumping 46,000 gallons per minute of water and sand mixture. This is sufficient to move 65,000 cubic yards of sand in one day.

**THE DREDGING** was a big task, even though the center of the channel was not touched. Finished line has about 80 feet of backfill on it at the bank. It simply lies on the bottom in main channel.

The dredge has an 1800-hp turbine which drives the electric generator that furnishes power to the 1300-hp cutter motor and other auxiliaries. This cutter has 48-inch diameter blades which loosen the sand to be pumped.

Quarters are provided for the crew since the dredging is a 24-hour-a-day job and facilities are adequate to accommodate a crew of 65 men with all the comforts of home. Meals can be served to 24 men at one sitting. The men work six eight-hour shifts per week and may stay on board if they choose.

**Pipe laying** started in early August. The 18-inch, 1⅛-inch wall seamless pipe was cleaned, primed, painted and double wrapped in the usual manner. But the welding was a slow, difficult job. It took two welders, using 3/16-inch rod about four hours to complete one of the welds.

After the pipe had been welded up into 80-foot sections on the river bank it was transferred to a 50 by 90-foot barge. Then as the pipe was needed it was transported to the laying barge in the river.

The ramp barge was 175 feet long with a 60-foot beam. It had a ramp suitable for easing the pipe into the river as the 80-foot sections were welded together. The laying opera-

**WALL OF PIPE** was over one inch. This 18-inch, 1.156-wall pipe used by TGT weighed 208 pounds per foot. Weights were unnecessary.

**PIPE WAS RAMPED** into the river from the lay barge shown here. The two barges at the left were used for lowering-in operations.

**LOOKING DOWN RAMP** of the lay barge. It took about four hours for two welders to complete weld of the heavy-wall pipe, using 3/16-inch rod.

tion was a round-the-clock job, and usually four of the 80-foot sections were laid in a 24-hour period.

The river approach lines are 24-inch by ½-inch wall pipe, coated, wrapped and weight-coated with a 2⅜-inch thickness of concrete giving the pipe a weight of 226 pounds per foot. This 24-inch weighted pipe is used between the levees and the underwater 18-inch near the banks of the river.

Thirty-inch headers are installed outside the levees where the three lines are tied together. The valves are installed so that in case of emergency either of the three underwater lines can be taken out of service.

**The three crossings.** The completion of this multi-line crossing marks the third for Tennessee Gas and gives the company a total of nine individual lines spanning the river. Four 26-inch lines on the Greenville bridge have comprised the main Mississippi crossing since 1950, when this highway bridge was revised to take their weight. Prior to this, the company's crossings consisted of two 18-inch lines on the side of the bridge.

In 1951 the second crossing of the river was made with two 16-inch heavy wall lines laid under the water near the bridge.

When it was decided to lay the new Kinder-to-Portland line a new location for the river crossing was chosen for safety and flexibility of operation. With the addition of this crossing a total of nine separate lines cross the river proper, thus insuring continuous operation of the pipe line system. This number of lines makes certain that gas can be delivered at all times. —**The End**

**GIANT DRAGLINE** was used in digging the approaches. Note the size of the automobile beside the cab. The bucket in the foreground has a capacity of eight cubic yards.

**About the Author**

CECIL B. PORTER, pipe line superintendent of Tennessee Gas, started in the pipe line game back in 1924 as a timekeeper. He soon broke out as a welder and worked for various contractors until 1933 when he went with Northern Natural Gas Company. In 1943 he joined Tennessee Gas as the twenty-second employe of the new company.

# Rules of Thumb

## FOR THE PIPELINER'S NOTEBOOK

### $15 Per Rule of Thumb

These formulae from the pages of engineers' own notebooks yield rough, but reasonably accurate answers for design, maintenance and supply questions. The Editors will pay $15 for your pet Rule of Thumb. Send your Rule of Thumb to Donald M. Taylor, Editor, PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1.

Miscellaneous

### —19—How to compare the cost of operating an engine on diesel fuel and natural gas.

**RULE: For a rough estimate of the cost of diesel fuel per hour of operation, multiply: (.05) (engine horsepower) (cost per gallon of diesel fuel). To find the cost of natural gas per hour's operation, multiply: (.008) (engine horsepower) (cost of natural gas per Mcf).**

Example: What would it cost per hour to operate a 500 horsepower engine on diesel fuel? on natural gas? Diesel fuel costs 10 cents per gallon and natural gas costs 20 cents per mcf.

Solution:

Cost/hour for diesel fuel operation = (.05) (500) (.10) = $2.50

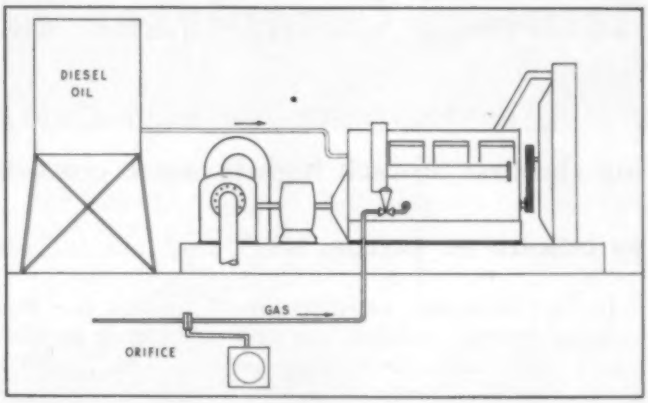
(A more accurate answer can be obtained by substituting .0533 for .05. This would make the cost of diesel fuel operation $2.67 per hour.)

Cost/hour for natural gas = (.008) (500) (.20) = $0.80

Example: Compare the cost of operating the engine on straight diesel fuel with dual fuel consisting of 90 percent natural gas and 10 percent diesel pilot fuel, if the conditions are the same as above.

Solution: Cost per hour = (.10) (2.50) + (.90) (.80) = $0.97.

Generally speaking, 1000 cu. ft. of natural gas has a Btu content of 1,000,000 and a gallon of diesel fuel has a Btu content of 150,000. Thus 1 Mcf of natural gas is equivalent to 6⅔ gallons of diesel fuel. To arrive at the figures above, the engine was assumed to require an average of 8000 Btu per brake horsepower hour. This is an arbitrary figure which is about the average for engines in good mechanical condition operating under high percentage of load. Some pipe line companies are equipped with engines that consume about 7000 Btu/bhp; others run as high as 11 Btu/bhp. Condition of the engine and the loading account for most of the difference.




If an engine used an average of 7000 Btu/bhp in developing its full horsepower of say, 1000, naturally it would use 7,000,000 Btu per hour. This would require 7 Mcf of natural gas or about 46.7 gallons of diesel fuel.

**BIGGEST INCH PIPE LINE** was laid like sewer pipe through the rolling country of Mississippi and the hills of Alabama. Line-up and welds were made in bell holes.

# Transco Completes 36-Inch Pipe Line

**The 'sewer pipe' method was used to save equipment and manpower in laying the first 36-inch high-pressure cross-country gas line.**

By **DONALD M. TAYLOR,** Editor, PIPE LINE INDUSTRY

IN THIS COUNTRY'S rapid post-war industry growth, nothing can compare in speed and scale with the rise of the pipe line industry. Since 1947, pipeliners have added 8000 to 18,000 miles of new lines to the nation's total every year, as investors flooded billions of dollars into both new and old companies.

But at the same time the pipe line networks were increasing in length, the individual lines being laid were becoming larger, and last year, more 30-inch line was laid than any other size pipe.

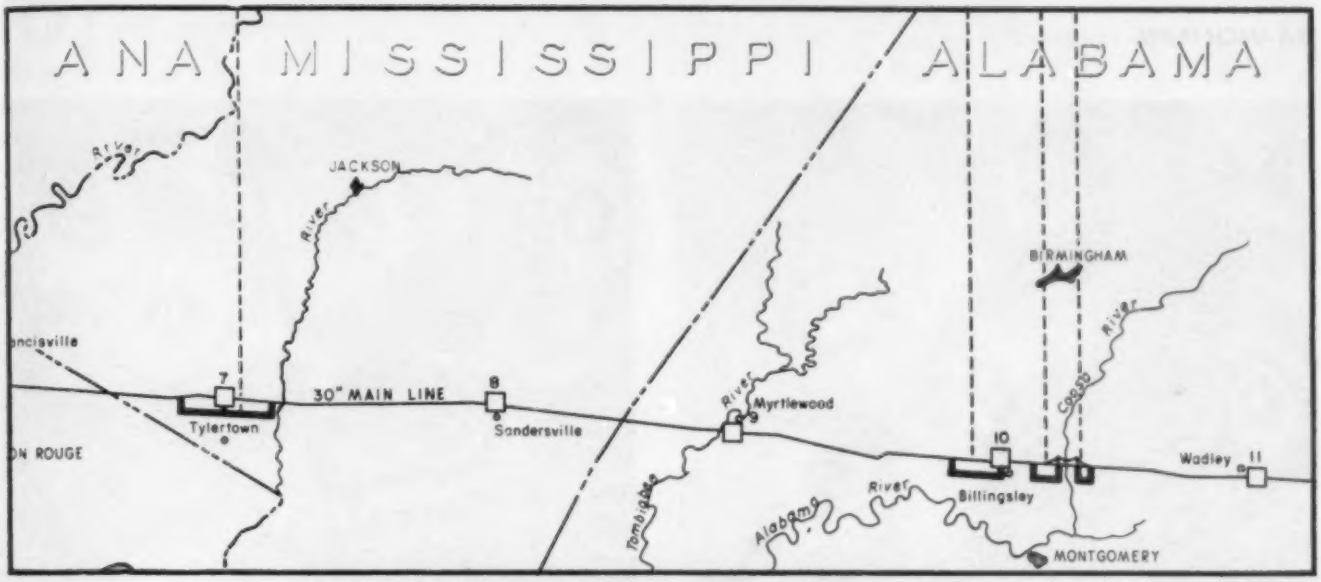
Not until this year did any company venture to lay anything larger than 34-inch pipe for cross-country high pressure transmission. Transcontinental Gas Pipe Line Corporation, the company that laid the first long-distance 30-inch line, pioneered in this field by constructing 48 miles of 36-inch line in Mississippi and Alabama. And pipeliners everywhere have been keeping an eye on the project. It's a safe bet that in the next few years other companies, too, will be laying lines of this size, because, generally speaking, the economics of large volume gas transmission favor the 36-inch line.

The advantages of large diameter lines are pointed up by the fact that last year almost 3000 miles (or 16 percent of the lines four inches and larger) of 30-inch were laid. But, surprisingly enough, only 150 miles or so of larger diameter lines were laid. In other words, the 30-inch was not only the most popular size of line laid, but also the maximum size that was laid.

Several factors accounted for this. For one thing, 36-inch pipe was not on the market and pipe mills were not equipped to hydraulically expand the pipe of this size. Moreover, there was the uncertainty as to whether construction equipment could handle pipe this heavy.

Yet, the 36-inch diameter pipe offered several exciting advantages. If suction and discharge pressures re-

*Text continued on Page 68*
*Pictures on following pages*




**MAP SHOWING LOCATION OF 36-INCH LOOPS**

**36-INCH LINE PIPE** used on the project was .406 wall, API, 5 LX-52. It weighed 155 pounds per foot. On highway crossings, valve settings, inside compressor station yards, etc., .469 wall pipe was used. Each joint was hydrostatically tested to 1170 pounds per square inch in the mill.

**PIPE WAS COATED** in pipe yards at Tylertown, Miss., and Selma, Ala. Asphalt enamel impregnated with fiberglass was covered with a final wrap of pipe line felt.

**AFTER COATING WAS APPLIED,** it was followed by whitewash to cool and set the newly-applied coating and to offset the effect of the sun on the line.

*Continued on next page*

**SPECIAL CRADLES** were used for hauling pipe on trailers. Note that the padded and rounded bolsters fit the contour of the pipe.

**PIPE WAS LANDED ON SKIDS,** most of which were hollowed out. Only the bare metal touches protecting the asphalt coating.

**RIGHT-OF-WAY WAS GRADED** to eliminate as many bends as possible. Because of the rugged terrain in Alabama, there was considerably more grading on the spreads than on those in Mississippi. The maximum bend that could be effected on a 40-foot joint without flattening the pipe more than 1½ inches out-of-round was 12 degrees. The entire line was engineered and constructed according to the ASA, B31, Section 8 Piping Code.

**ALL DITCHING WAS DONE WITH BACKHOES,** five to the spread. These backhoes leap-frogged to complete about 4000 feet of ditch per day. The ditches were 5½ feet deep with bell holes 14 to 18 inches deeper.

**MOST IMPORTANT MAN ON RIGHT-OF-WAY** from the contractor's standpoint was the engineer who staked out the bell holes. He had to calculate the effect of the bends, as well as the length of the pipe, to determine them. If he missed one bell hole, all the subsequent bell holes would be in error.

**ONE OF THE BIG PROBLEMS** on a line such as this was that of bending the pipe. Transco engineers, who had been studying the possibility of laying a 36-inch line for some time, encouraged manufacturers to develop a bending machine that would handle the pipe. Back in 1950 Transco provided two of the leading equipment manufacturers with .309-wall 36-inch pipe for experimental purposes. With this wall pipe, 9 degrees was the maximum bend per joint, but with the heavier pipe used on this line, 12 degrees was possible. Two joints were used for greater bends.

**CREEKS AND SMALL RIVERS** were crossed by welding up the section of the line, floating it into place, then adding concrete weights from above to give it negative buoyancy. In every instance, samples of the material that would form the bed for the pipe were weighed and sufficient weights were added to give the pipe a negative buoyancy of 20 pounds per foot.

*Continued on next page*

**36-INCH LINE** *continued*

main the same, the quantity of natural gas flowing through a section of line will vary according to the 8/3 power of the diameter, according to the Weymouth formula. On this basis, a 36-inch line will transport 60 percent more gas than a 30-inch line and almost three times as much as a 24-inch line. Where the quantity of gas throughput remains the same, considerably less horsepower is required to move the gas through the larger sized line.

Recognizing the advantages of lines larger than 30-inch, Pacific Gas and Electric Company laid several hundred miles of 34-inch line during the past few years.

Transco engineers studied PG&E's methods, conferred with contractors and steel mills, decided that the 36-inch was feasible, and requested FPC to authorize 48 miles of this size line on the company's Sun Loop.

**SEWER-TYPE METHOD** of laying pipe graphically illustrated above. The two tractors worked with the side gang. One moved ahead and lifted the next joint from the center point which was clearly marked and moved it back to the internal mechanically-actuated line of clamps. Three stringer bead welders immediately made the first pass. Behind them came two hot-pass welders who made the hot-pass weld and one fillet weld. In the distance can be seen the ten firing-line welders who were able to complete about 90 welds per day on the Mississippi spread. Progress was slower in Alabama because of terrain. There the average was about 70 welds per day.

**CLEANING AND TESTING** followed code requirements. The line was pigged and blown two or three times after construction and then hydrostatically tested for 24 hours. Following the hydrostatic test, the line was pigged and cleaned until dry.

**KEY MEN** on the job in Mississippi were (left to right) E. D. Singleton, Associated's spread superintendent; Jack Barnett, Transco's chief inspector; I. W. (Spider) Dods, Transco construction superintendent; D. L. Doss, construction accountant, and E. E. Holden, Transco division superintendent. —**The End**

**LUMBERTON PUMP STATION.** At the right is the steam heating equipment with four small boilers for warming the oil to be loaded in tank cars and two boilers for heating the station throughput. At left is pump building with diesel-driven reciprocating pumps.

# Pipelining High-Viscosity Crudes

**Gulf Refining Company's 88-mile steam-heated pipe line has been in operation more than two years. Here's how it was designed and how it is operated.**

**By MORGAN MARTIN,** Gulf Refining Company, Houston

CRUDE OILS FOUND in several of the fields of the State of Mississippi are very heavy and require heat for efficient moving by pipe line. Baxterville oil is the heaviest of these oils and at 60° F. has a viscosity of 17,400 SUS and a gravity of 16.4 API.

The first step in planning a pipe line to handle such a viscous oil is to have laboratory tests run on a sample at various temperatures to obtain viscosities and gravities to use in the formulas. Additional information such as atmospheric temperatures, kind and conditions of soils through which the proposed pipe line will run, elevations along the route are all needed before proper design work can commence.

The best known data on handling heated oil in pipelines is that found in a series of articles written by Fritz Karge, formerly chief engineer of an oil company in California.[1] Karge's formula, along with a pipeliner's interpretation, is given in the Appendix for reference.

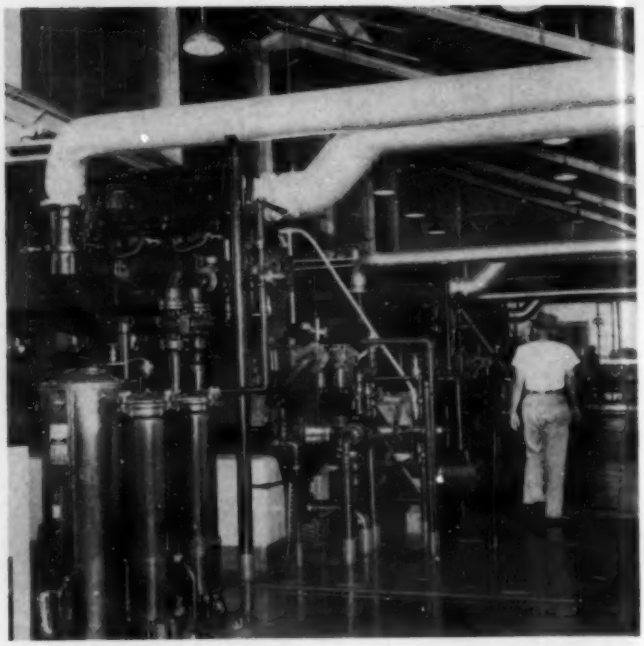
From the Btu loss from heated oil and Btu loss from a pipe line to the surrounding ground the following formula is obtained:

Heat is lost from the pipe surface to the surrounding ground in the case of buried lines, and the average temperature of the ground is very close to the average daily atmospheric temperatures. The condition and type of soil covering the pipe is a large factor in these heat losses.

Karge's values for the coefficient of heat loss K are given in the appendix. The importance of obtaining a good understanding of the medium through

$$= \frac{\text{Degree loss/mile/1 deg. difference in temperature}}{\text{outside area of line per mile} \times \text{coefficient of heat loss K}} \over \text{weight of bbl. of oil} \times \text{specific heat of oil} \times \text{bbl. per hr.}$$

**RECIPROCATING PUMPS** that handle heavy crude. The surge chambers at top are filled with high-pressure natural gas.



**DUAL FUEL ENGINES** that use 90 percent natural gas and 10 percent diesel pilot fuel are semi-automatic in operation.

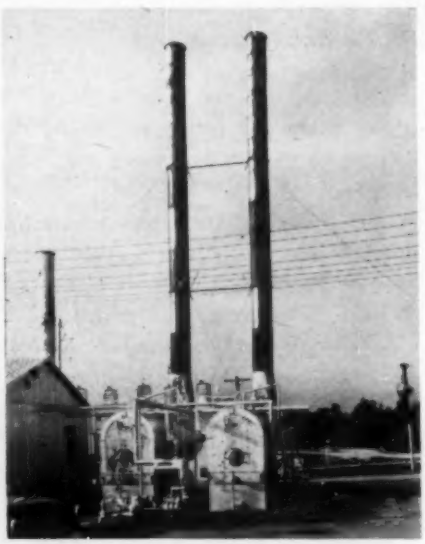
which the pipe line is to be laid cannot be overemphasized.

In designing a pipe line to handle the Baxterville crude, the first two important factors to be considered were the capacity of the proposed line and the route. Based on known and anticipated developments in the areas to be served by the line, a capacity of 42,000 barrels per day was decided upon. As for the route, a survey showed the nearest deep-water port to be 88 miles distant. A top operating pressure of 1000 pounds per square inch was used for the line in order that excessive loads would not be exerted on the positive-displacement pumps.

Along with the line survey a soil-analysis survey was conducted, and information weighted out from the detail survey indicated that a K-factor of 1.0 would cover the worst winter conditions to be expected along the route. Study of the U. S. Weather Bureau information indicated that a 50° F. atmospheric temperature would be an average low for winter time for calculation purposes. Short, sharp, low atmospheric temperatures have very little effect on ground temperatures at pipe line depths of 24 inches or more of cover. Winter conditions were used for design purposes since oil must be moved throughout the year.

Because heat loss is dependent on the temperature difference between the oil and the ground it is desirable that this difference be held to a minimum. After all, from a dollar standpoint, Btu put into the oil are obtained from Btu paid for in the heating medium.

An investigation of the Baxterville oil at 130° F. initial temperature against the 50° F. ground temperature with a K-factor of 1.0 was started. A calculation sheet was devised in order that all factors could be set out clearly for analysis and further use.



**TWO 300-HP BOILERS** at Lumberton furnish steam for heating the crude oil.

Table 1 shows such a typical calculation sheet. Calculations are based on one-mile sections on the pipe line, and since these sections are rather short and the temporary difference not very large the average temperature is taken as an arithmetical average. This short cut saves the engineer numerous calculations over the logarithmic method of finding averages, and the percent of error is no greater than the assumptions on the weather to be expected and on the soil conditions to be found along the completed line.

Using the viscosity curve of the oil to be pumped (plotted from laboratory tests) the SUS viscosity and degrees API gravity are determined for the average temperature for each one-mile section. Taking the three factors now known, barrels per hour, SUS viscosity, and degrees API and entering these on a curve for 14-inch pipe to determine the pressure drop in pounds per mile is the next step. Since practically all organizations which do any calculations on pipe line flow have their own pressure-drop curves, no attempt will be made here to explain their construction or use.

Two columns for pressure drop are used since heavier wall pipe for the

discharge side of the stations is rather standard pipe line procedure.

The next column on the data sheet shows the accumulated pressure drop, and from the Table 1 example for a 10-mile section it is apparent that reheat will be needed between 8 and 9 miles in order that 1000 psi discharge pressure will reach for five sections of approximately 200 psi pressure drop in each section.

For the Mississippi pipe line of 88 miles total length this meant a booster station halfway down the line and four intermediate heater stations in each pumping section.

A study of elevations between pumping stations for consideration of static help or loss, as well as adding the pressure drop through the five sets of heaters, gives the total discharge pressure necessary at each of the two stations.

**Mechanical equipment.** Prime movers at Lumberton, the originating station, and Lucedale, the intermediate station, are three gas-diesel five-cylinder engines rated at 400 brake horsepower and 400 revolutions per minute. Attachments of the very latest design enable the engines to convert automatically from dual fuel to full diesel and back to dual fuel again. Sensitive pneumatically operated hydraulic governors incorporated in the engines give a very close speed control and work in conjunction with a pressure controller where desired. Diesel oil is used for pilot fuel since none of the crude oils found in Mississippi is suitable for fuel in this type engine.

With the wide speed-range characteristic of the multicylinder engines each pump has a capacity between 13,500 and 16,500 barrels per day. This high flexibility makes possible the shutting down for repairs or adjustments of one unit, and letting the other two carry the load under most operating conditions.

Oil tanks at Lumberton are equipped for steam heating the oil by using a two-inch pipe coil inside a wood box through which the oil flows when filling or emptying the tanks. The coil is divided into three sections and valved outside the tank shell for flexibility of handling.

Suction lines between the tanks and pump station have steam lines inside so sluggish oil can be heated in order that the pumps will fill effectively.

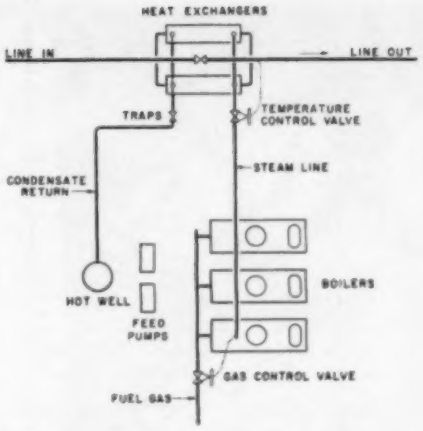



Fig. 1—Schematic diagram of heater station.

For the oil-heating unit at the pumping stations, as well as at the heater stations, three-150-hp 300-psi-WP oil-country-style boilers are used. Live steam used in two shell-and-tube heat exchangers provides the desired quantity of heat needed to make the heavy oil pumpable at pressures desired on the pipe line.

Since there is natural gas available for fuel at all locations, combination gas-oil burners were installed in the fireboxes. In event of an interruption of gas supply, the burners can be switched over to crude-oil-burning, since heat absolutely must be available when needed.

In order that two boilers will be able to furnish all the heat needed in the wintertime, in the event one boiler is out of service for any reason, extended fireboxes and extra long stacks were added to each setting. Boilers were covered with an insulating jacket, heat exchangers and all piping properly insulated, and feedwater heated by the returning condensate, all in order to conserve all the heat possible.

To make the heater stations as automatic as possible, auxiliary equipment includes temperature controller and control valve at the heat exchangers, pressure-operated gas-firing controller, feed-pump governor, feedwater regulators, low-water alarms and fuel shut-off-valves. A 100-barrel fuel tank, with steam-heating coil inside, erected on a tower nearby makes oil fuel readily available in the event of a gas-line failure.

The boilers, feed pumps and heaters are out in the open with a suitable shelter nearby for the fireman, his supplies and telephone. Regular oil-country-style boilers and standard manufactured shell-and-tube heaters were considered to be the most suitable from the standpoint of availability, lower cost, safety in operation, and simplicity of maintenance and repairs.

Diagram of a typical heater station is shown in Figure 1.

**Operation.** Lumberton station pumps both Baxterville oil, the heavy oil the line was designed for, and Eucutta mixture, still a heavy oil when compared to the average crude oils, but light oil when compared to Baxterville. Characteristics of the two oils are shown in Figure 2. Production rates are approximately equal between the two oils, and pumpings are scheduled in blocks of approximately 40,000-50,000 barrels each.

This type operation makes for very erratic discharge pressures at the

**TABLE 1—Heat Loss and Pressure Drop Calculations**

14" Line at 42,000 B/D or 1750 B/H — K = 1.0 — Ground Temp. 50° F.
Degree Loss/Mi./1° Diff. in Temp. = 0.0671 — Specific Gravity 0.94

| Mile | Temp. In | Diff. Temp. | Deg. Loss | Temp. Out | Avge. Temp. | Viscosity SUS | GRAVITY A.P.I. | GRAVITY S.G. | P.D./1 Mi. 5/16" W.T. | Total No. P.D. | P.D./1 Mi. 1/4" W.T. | Total No. P.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 130 | 80 | 5.4 | 124.6 | 127.3 | 970 | 20.1 | .9340 | 12.1 | 12.1 | 11.6 | 11.6 |
| 2 | 124.6 | 74.6 | 5.0 | 119.6 | 122.1 | 1160 | 19.8 | .9352 | 13.1 | 25.2 | 12.6 | 24.2 |
| 3 | 119.6 | 69.6 | 4.7 | 114.9 | 117.2 | 1360 | 19.5 | .9371 | 17.0 | 42.2 | 16.3 | 40.5 |
| 4 | 114.9 | 64.9 | 4.4 | 110.5 | 112.7 | 1590 | 19.3 | .9383 | 19.7 | 61.9 | 19.0 | 59.5 |
| 5 | 110.5 | 60.5 | 4.1 | 106.4 | 108.4 | 1850 | 19.1 | .9396 | 23.1 | 85.0 | 22.3 | 81.8 |
| 6 | 106.4 | 56.4 | 3.8 | 102.6 | 104.5 | 2130 | 18.9 | .9408 | 26.5 | 111.5 | 25.6 | 107.4 |
| 7 | 102.6 | 52.6 | 3.5 | 99.1 | 100.8 | 2470 | 18.7 | .9421 | 30.8 | 142.3 | 29.7 | 137.1 |
| 8 | 99.1 | 49.1 | 3.3 | 95.8 | 97.4 | 2780 | 18.5 | .9433 | 34.4 | 176.7 | 33.2 | 170.3 |
| 9 | 95.8 | 45.8 | 3.1 | 92.7 | 94.2 | 3150 | 18.3 | .9446 | 39.1 | 215.8 | 37.7 | 208.0 |
| 10 | 92.7 | 42.7 | 2.9 | 89.8 | 91.2 | 3550 | 18.1 | .9459 | 43.9 | 259.7 | 42.3 | 250.3 |

$$\text{Deg. Loss/Mi./1° Diff. in Temp.} = \frac{19{,}352 \times 1.0}{350.72 \times 0.50 \times 0.94 \times 1{,}750} = 0.0671$$

pumping stations. A 7-day example in April is shown in Figure 3. As Baxterville oil filled the line all the way from Lumberton station to Lucedale station the discharge pressure climbed to a high of 860 psi.

With starting of Eucutta mixture the pressure fell to a low of 220 psi by the time the section Lumberton to Lucedale was completely filled with the lighter oil. The next block of Baxterville oil caused the pressure to climb back up again, and the cycle continued day after day.

Since the 14-inch line has been completed in Mississippi the weather has not been severe enough during the winter, or have pipe line runs

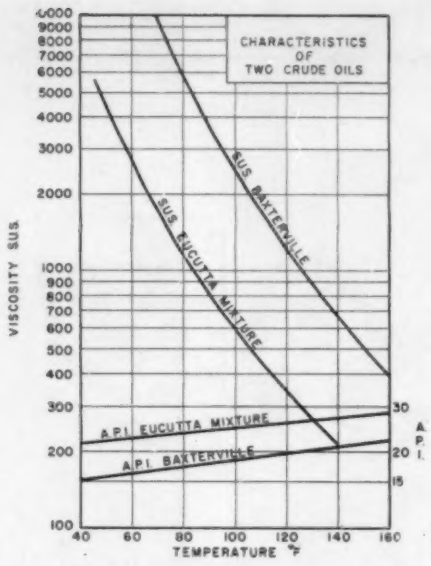



Fig. 2 (above)—Characteristics of two crude oils.

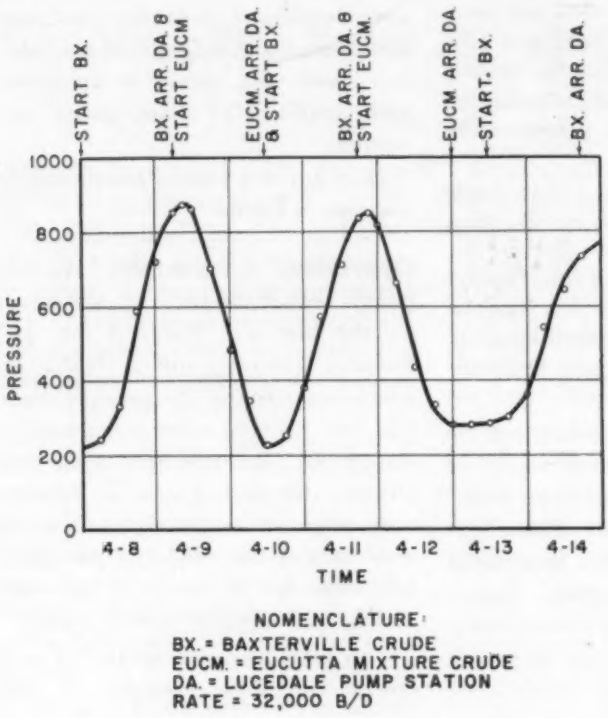



Fig. 3 (left)—Typical seven-days discharge pressures Lumberton pump station.

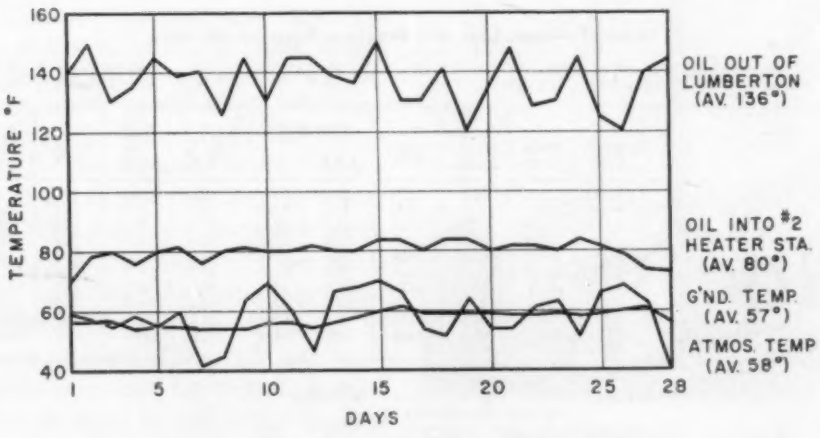



Fig. 4—Temperature control.

reached the 42,000-barrel figure, in order that the operating conditions could be field-checked against the design for maximum flow.

Operations during February, 1954, were quite steady at 32,000 barrels per day, and information obtained from pumping records and test observations were used to check the design formula as nearly as possible.

Figure 4 shows the temperature record for the 28-day month. Note that the atmospheric temperature averaged 58° F. The ground temperature taken at pipe line depth at Lumberton averaged 57° F. These are daily averages between the high at 1 p.m. and low at 5 a.m. Note the little effect daily highs and lows of atmospheric temperatures had at this depth in the ground.

During the winter months it is the custom at Lumberton to add heat in the line with the starting of Baxterville crude, and lessen the heat on starting the Eucutta mixture. From the top line plotted on Figure 4 this is quite apparent. Average input temperature was 136° F. for the month.

Temperature of the oil incoming to the No. 2 heater station 17½ miles down the line averaged 80° F., and as shown indicated very little difference because of the range of temperatures at Lumberton.

Taking a record of pressures and temperatures for a block of Baxterville during an even period of pumping, and for an even period of weather during February, a check was made against the design formula.

A study of the weighted averages on soil conditions mentioned earlier indicated that the line from Lumberton to No. 2 heater station was laid in sandy-clay soil and the condition was moist to wet. From heater station No. 2 to No. 4 the soil was predominately clay, and more moist than wet. The section from heater station No. 4 to Lucedale station crosses the Pascagoula River and several miles of river bottoms which are sandy soil and wet.

For use in the formula $K = 0.75$ for the sandy-clay, moist to wet section; $K = 0.65$ for the clay, more moist than wet; and $K = 1.70$ for the river and wet bottom lands, all values which fit very well into the table of Karge's K-factors shown in the appendix.

These K-values when used in the

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formula shown earlier in Table 1 produced the terminal temperatures at the end of the three sections under observation. Pressures, when corrections were made for static help and heat-exchanger friction, were found to be within 5 pounds of the gage readings.

Another investigation was made in April on the 27-mile section between Lumberton and heater station No. 3 as shown in Table 2. By this time of year the sandy-clay soil was not as wet as in February so a K-value of 0.60 was used. Results as obtained from the calculations were the same as for the observed conditions.

These two checks, one in February with moist to wet soil and a ground temperature of 55° F., and another in April with drier weather and a ground temperature of 70° F., come close enough to observed conditions for all practical purposes of pipe line work.

One-mile intervals were used in the calculations for the original design but the use of 2- or 3-mile intervals will produce results within 4 or 5 percent of the longer detailed method, which may be considered satisfactory for quick checks on pipe line operations.

Several checks of operations of the heater stations were considered and the total Btu in the gas burned against the Btu put into the oil stream in added temperature produced over-all efficiencies for the heater stations of 65 percent. The extended fireboxes, long stacks, boiler-jacket insulation, heater and steamline insulation all helped to reach these efficiencies.

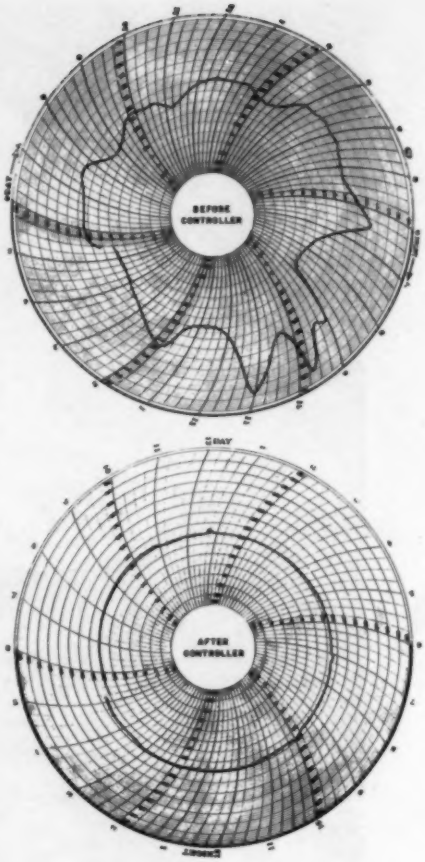


Fig. 5—Suction pressure control.

One other feature when handling highly viscous crude oils by pipe line is that of effective filling of the pumps on the suction stroke. At Lumberton, oil in the tanks and in the suction line is heated to approximately 100° F., so the pumps fill satisfactorily from tank head.

At Lucedale, the intermediate station, Lumberton pumps directly into the station suction line, and this pressure is not only subject to the sluggishness of the oil being pumped but also subject to the slight variations in engine speed.

Figure 5 shows very vividly the comparison between suction-pressure charts "before" and "after" a suction controller was installed to work in conjunction with the sensitive pneumatically operated hydraulic governors on the engines. When operating on hand control the station engineer adjusted the engine speed several times each tour, whereas after the controller took over the record is very smooth except for operation of the automatic sump pump, which discharged into the suction line periodically.

One other interesting phase of operation of a heated-oil pipe line occurred when it was necessary to shut the line down. During a rainstorm and impending hurricane last September it was deemed advisable to suspend operations and clear the area of personnel, so the line was shut down at 6 p.m. in the afternoon. The storm blew over and operations were resumed at 8 a.m. the next morning.

One section of the line was full of the lighter crude and the other with the Baxterville oil. One pump at each station was started and operated at the slowest recommended engine speed for three hours before the second unit was put on the line. The 14-hour stoppage of flow did not cause excessive heat loss to the ground as incoming temperatures at the heater stations showed only 4° to 6° F. lower than before the stoppage. This fact was apparent too in the station discharge pressures, a top pressure of 530 psi was reached in three hours, with the one unit pumping at 80 percent capacity. Four hours after the second unit was added, operations were quite normal again with pressures and temperatures as usual.

**TABLE 2—Heat Loss and Pressure Drop Calculations**
**Lumberton to Heater Station No. 3**
**April 9, 1954**

14" O.D. Line at 32,000 B/D or 1333 B/H — K = 0.60 — Ground Temp. 70° F.
Degrees Loss/Mi./1° Diff. in Temp. = 0.0528 (3 mi. .. 0.1584) — Specific Gravity 0.94

| Mile | Temp. In | Temp. Diff. | Deg. Loss | Temp. Out | Avge. Temp. | Viscosity SUS | GRAVITY A.P.I. | GRAVITY S.G. | P.D./3 Mi. 3/8" W.T. | P.D./3 Mi. 7/16" W.T. | Total P.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 140 | 70 | 11 | 129 | 134.5 | 780 | 20.2 | 0.9328 | 21.9 | ... | 21.9 |
| 6 | 129 | 59 | 9 | 120 | 124.5 | 1170 | 19.8 | 0.9352 | 33.0 | .... | 54.9 |
| 9 | 120 | 50 | 8 | 112 | 116 | 1400 | 19.3 | 0.9383 | 39.6 | .... | 94.5 |
| 12 | 112 | 42 | 7 | 105 | 108.5 | 1800 | 19.0 | 0.9402 | 50.4 | .... | 114.9 |
| 15 | 105 | 35 | 6 | 99 | 102 | 2300 | 18.5 | 0.9433 | 66.0 | .... | 210.9 |
| 18 | 99 | 29 | 5 | 94 | 96.5 | 2900 | 18.2 | 0.9452 | .... | 78.9 | 289.8 |
| 21 | 94 | 24 | 4 | 90 | 92 | 3400 | 18.0 | 0.9465 | .... | 96.0 | 385.8 |
| 24 | 90 | 20 | 3 | 87 | 88.5 | 4000 | 17.8 | 0.9478 | .... | 114.0 | 499.8 |
| 27 | 87 | 17 | 3 | 84 | 85.5 | 4500 | 17.6 | 0.9490 | .... | 129.0 | 628.8 |

**OBSERVED CONDITIONS**

| | | | |
|---|---|---|---|
| Lumberton Temperature | 140° | Lumberton Pressure | 880 Lb. |
| No. 3 Heater Station Temperature | 84° | No. 3 Heater Station Pressure | 280 Lb. |
| | | | 600 Lb. |
| | | Static Help | 28 Lb. |
| | | Total P.D. | 628 Lb. |

**Conclusion.** Although pipe line engineers design lines for certain operation pressures, and in the case of heated-oil lines for certain operating temperatures, the practical pipeliner varies these factors somewhat for daily conditions.

Instead of keeping a minimum temperature to give the maximum discharge pressure, day-to-day conditions dictate that a little more heat be put into the system so operations

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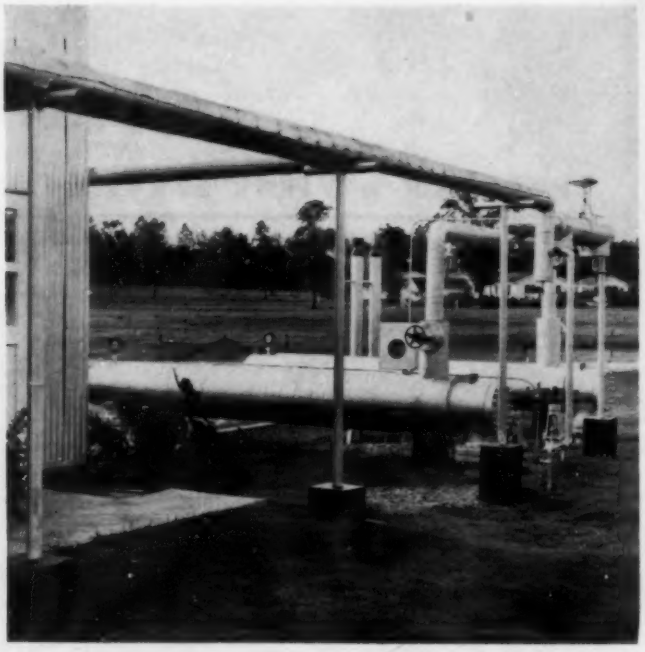
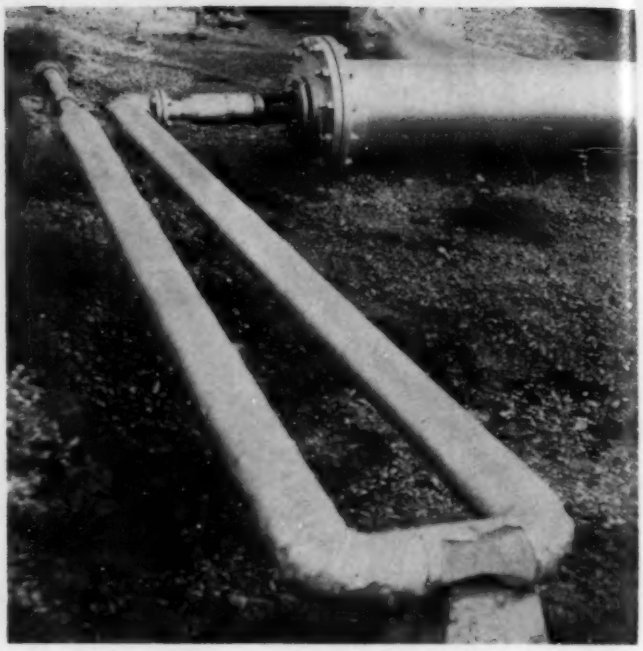
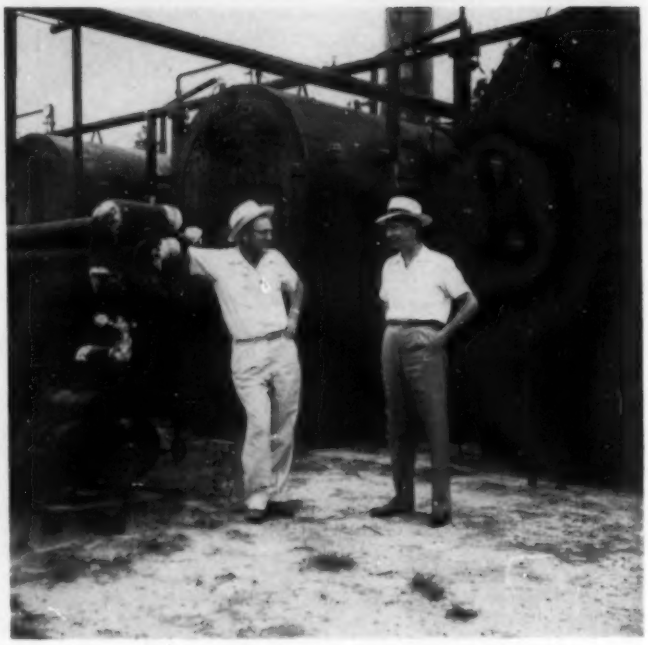




can go forward at less discharge pressure than the design maximum.

This condition leaves the operator with some leeway both in heating and in pressure, and in event of an upset in weather, or in operating conditions, may mean the difference between meeting, or falling behind on, the requirements of the day.

A pipe line which has a fair margin of safety built into its design, and also is operated with some leeway, certainly has a very good chance of producing the results it was built for, and most important of all, being a money-making property.



**HEAT EXCHANGERS** (above left) which "melt" the high-viscosity crude. Above right are lines to storage tanks. These lines are also steam-heated. Intermediate heater station has three 300-hp boilers (right) that are automatically controlled during operation.


**REFERENCE**

[1] March, April, May, 1945, *Petroleum Engineer*.


## APPENDIX

Nomenclature used in heat-loss formula:

$t_1$ = difference between initial temperature of oil and atmospheric temperature.

$t_2$ = difference in final temperature of oil and atmospheric temperature for the X mile section under consideration.

tm = mean difference in temperature between oil and atmosphere.

C = average specific heat of oil

s = average specific gravity of oil

Q = flow rate, bbl. per hr.

K = heat-transfer coefficient, oil to ground (Btu/hr/sq ft/deg F)

D = OD of pipe, in.

X = length of line, miles

W = weight of barrel of water (350 lb)

Btu loss from oil equal = W s C Q $(t_1 - t_2)$

Btu loss also equal outside surface area of pipe for length under consideration times mean temperature difference times heat-transfer coefficient.

$$\frac{\pi D}{12} \times 528 \text{ tm K}$$

combining W s C Q $(t_1 - t_2)$ =

$$\frac{\pi D}{12} \times 5280 \text{ tm K}$$

$$\text{and } t_1 - t_2 = \frac{\frac{D}{\pi\ 12} \times 5280 \text{ tm K}}{\text{W s C Q}}$$

$$\text{therefore } \frac{t_1 - t_2}{\text{tm}} = \frac{\frac{\pi D}{12} \times 5280 \text{ K}}{\text{W s C Q}}$$

For investigation of 1-mile intervals this can be expressed as:

$$\text{Degree/loss/mile/1 deg F difference in temperature} = \frac{\text{outside area of line per mile} \times \text{K}}{\text{weight of barrel of oil} \times \text{specific heat} \times \text{barrels per hour}}$$

—The End

**Table of K-Factors (From F. Karge)**

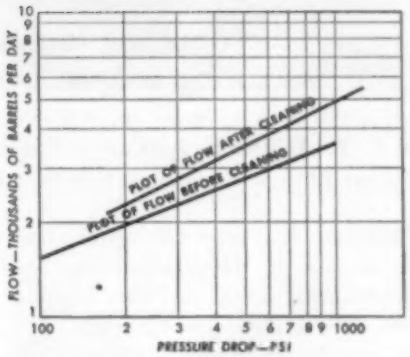
(K in Btu per square foot per hour per degree difference in temperature of oil and temperature of air)

| Soil | Condition | Cover, In. | K |
|---|---|---|---|
| Sandy | Dry | 24 | 0.25 to 0.40 |
| Sandy | Moist | 24 | 0.50 to 0.60 |
| Sandy | Soaked | 24 | 1.1 to 1.3 |
| Clay | Dry | 24 | 0.20 to 0.30 |
| Clay | Moist | 24 | 0.40 to 0.50 |
| Clay | Moist to Wet | 24 | 0.60 to 0.90 |
| Sandy | Dry | 8 | 0.60 to 0.70 |
| Sandy | Moist to Wet | 8 | 1.2 to 2.4 |
| River | 60 inch water | 60 | 2.0 to 2.5 |
| Air | Exposed | .. | 2.0 (approx.) |

Factors are for bare steel pipe, reduce by 15 percent for 3/16 to 1/2 inch thick asphalt and felt wrapping.

# 80-MILE LPG LINE CLEANED CHEMICALLY

## DOWELL restored original capacity without digging up the line




*Graph shows a 40.6% increase in the volume of fluid handled by the line after chemical cleaning.*

An 80-mile LPG* line supplying a petrochemical company suffered a serious pressure drop and a substantial decrease in capacity because of iron oxide deposits.

Dowell engineers pumped specially prepared chemical solvents into one end of the 4" line, treating the entire 80-mile length as a single unit. No intermediate entry points were needed, so no digging was necessary to complete the cleaning. The line's original capacity was restored and the job finished in only ten days.

Many types of lines, heat exchange and process equipment have been cleaned the Dowell way. Here's how: Dowell engineers bring all the necessary equipment and solvents right into your plant. Dismantling of the unit to be cleaned is kept to a minimum, since solvents are introduced through regular connections. Bends, elbows, valves and other normally inaccessible surfaces are reached effectively. Inhibitors are added to protect against metal loss during cleaning. With extremely hard scale, jet moles and pipe line pigs supplement chemical action. Most jobs take only a few hours. Often, equipment can be cleaned while in operation.

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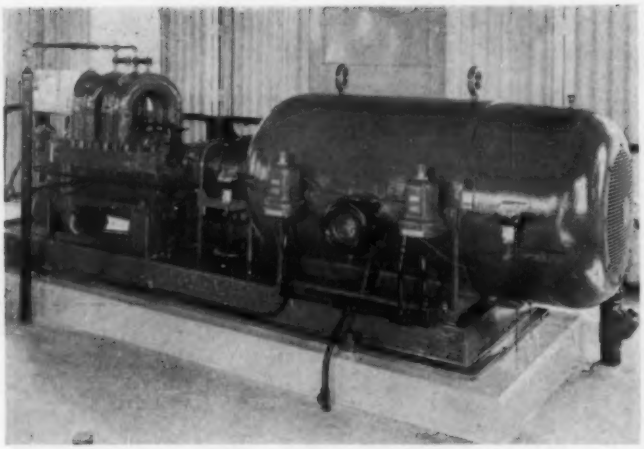

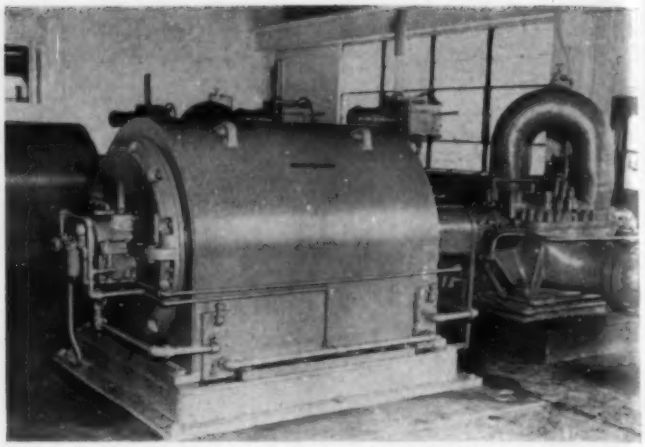

Fig. 1 (left)—One of main motors each coupled to centrifugal pump. Totally-enclosed fan-cooled motor, 350-horsepower, 360-revolutions per minute, 2200-volt, three-phase, 60-cycle, for hazardous gas location, Class 1, Group D, with oil-lubricated sleeve bearings and explosion-proof bearing temperature relays.
Fig. 2 (right)—Pipe line base ventilated motor Type K, 1500-hp, 3600 rpm in pumping station.

***In pipe line pumping***

# Evaluating the Performance of Motors

- **Reduced voltage starting usually unnecessary.**
- **Reduction of inrush current may reduce efficiency.**
- **Starting torque is relatively unimportant except for its effect on accelerating torque.**

**By E. B. TURNER,** Industrial Engineering Section,
General Electric Company, Schenectady, N. Y.

MOTORS FOR pipe line application are usually of the squirrel-cage induction type with the size ranging from 350 to 3500 horsepower. They are usually considered "special purpose" motors rather than "general purpose" motors as defined by the American Standards. As such, their characteristics are usually tailored to the specific application.

Pipe line motors at times present application problems and in order to overcome a specific difficulty, one or more desirable characteristics may be unnecessarily penalized. The following paragraphs will outline the characteristics which contribute to a well-balanced and correctly applied pipe line pumping motor.

There is no question about the horsepower and the speed since the hydraulics of the line and the type of pump are the determining factors here. Centrifugal pumps are usually driven by 1800- or 3600-revolutions per minute squirrel-cage motors (Figures 1 and 2) while reciprocating pumps are usually driven by low-speed synchronous motors.

**Type of motor.** The normal starting torque, low slip type of squirrel-cage induction motor is usually specified for this application. It is sturdy and simply constructed, has the least number of insulated parts, fewest windings, no commutator, no brushes, and no sliprings (Figures 3 and 4). The essentially constant load-speed characteristic of this motor sometimes arouses unfavorable comment due to throttling losses encountered at reduced flows.

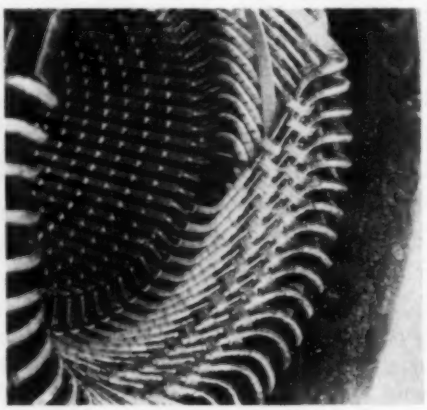

Fig. 3—Partially wound stator of squirrel-cage induction motor showing coils laces to binding bands.

However, in order to obtain an adjustable speed drive, either direct-current motors or type M wound-rotor motors would have to be applied. In considering the d-c case, it should be remembered that any conversion equipment inserts an additional loss in efficiency in a system which is inherently less efficient.

This indicates that unless reduced flow operation is extensive, little benefit is derived. If reduced flow operation is extensive, then multiple type K units should be considered to reduce throttling losses and take advantage of their high efficiency when operated close to rated load.

There are at present a relatively small number of type M wound-rotor

**Part 1**

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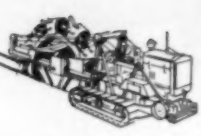

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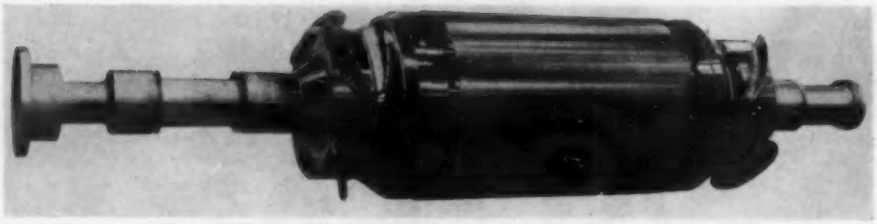


Fig. 4—Cage rotor for base-ventilated polyphase induction motor, 14000 hp, 3600 rpm, 2200 volts, 60 cycles, type FT. Approximately 1/12 size.

motors in use on pipe line applications (Figure 5). These are good reliable drives and if a single-motor station is being built, consideration should be given to using this type of motor. However, *where there is more than one motor in a station, type K squirrel-cage motors are usually applied.* Schemes employing one or more "full-size" units and one "half-size" unit are very flexible and greatly reduce throttling losses without sacrificing efficiency at reduced throughput. With the present trend toward remote control of pipe line pumping stations and the use of centrifugal compressors, the simple construction of the type K squirrel-cage motor is generally conceded to have the most advantages.

**Motor enclosure.** Since the main-drive motor is directly connected to the pump, it is normally considered to be in a hazardous location. There are a number of station equipment layouts in which the control and switchgear are isolated from the pipe line to permit using standard industrial-type enclosures. Physical separation of the motor and pump by the use of a fire wall, although sometimes used, is not considered too practical from an economic viewpoint.

If the pump and motor are outdoors, a totally-enclosed, fan-cooled, Class 1, Group D motor (Figure 6) is usually applied. This type enclosure is available up to 1250 horsepower. In addition, a few totally-enclosed forced-ventilated motors (Figure 2 modified) are planned for outdoor use but since most operators are unwilling to take cooling air directly at the motor, the physical problem of duct work has to be considered in the selection of this enclosure for any outdoor installation.

Another alternative is the totally-enclosed, inert gas filled surface-cooled motor (Figure 7). However, this has not found wide acceptance on pipe line applications due to the water requirements of its gas-to-water heat exchangers.

Most of the pipe line pumping stations have the pumps and motors installed indoors to facilitate maintenance on the pumps.

By mounting the motor indoors, it is possible to economically and safely apply totally-enclosed forced-ventilated motors (Figure 2) by using a blower motor which is located at the intake extremity of the duct work, drawing air from a safe location. This means that the entire duct work is operating with a positive head of ventilating air. Any leakage would have to take place from the inside of the duct work to the outside and possibly contaminated air is thereby excluded. Various safety systems are used to shut down a unit if this ventilating air pressure should fail or fall below a safe minimum value.

It is easy to see that there is no single answer to the question of enclosure. However, in the general outdoor case (1250 horsepower and below), the totally-enclosed, fan-cooled, Class 1, Group D Explosion-proof motor (Figure 6) finds the widest application. For the indoor case there is an overlapping area in which either the totally-enclosed, fan-cooled, Class 1, Group D motor (Figure 6) or the totally-enclosed forced-ventilated motor (Figure 2) can be applied. This is due to the fact that although the totally-enclosed forced-ventilated motor is less expensive, the ventilating system it requires has to be considered as part of the cost of the motor.

Therefore, the elaborateness of the building and the ventilating duct work will determine where the breakdown point between these two enclosures occurs. This overlapping region is from 500 to 1250 horsepower. Above 1250 horsepower, the totally-enclosed forced-ventilated is definitely advantageous.

**Motor voltage.** Voltage is not always a real consideration since in

*Continued on Page 84*

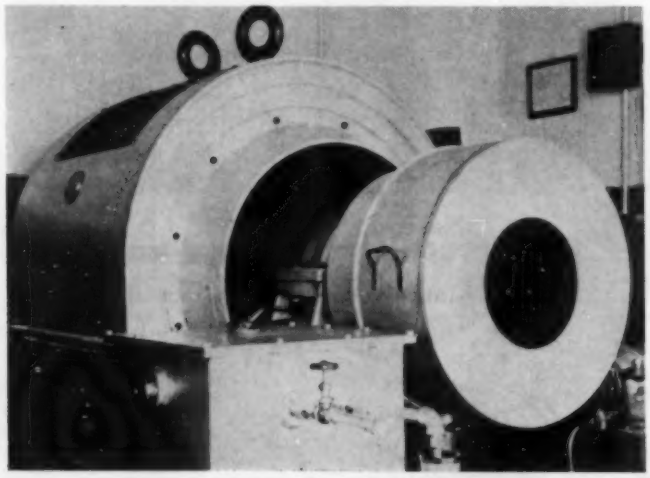


Fig. 5—Wound-rotor induction motor with enclosed collector and with pressure lubrication, coupled through wall, to centrifugal pipe line pump. Motor, 600 hp, 3600 rpm, 2200 volts, 60 cycles, type MT.

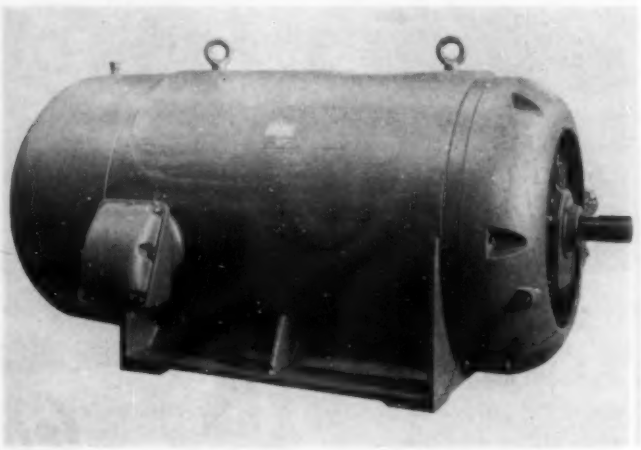
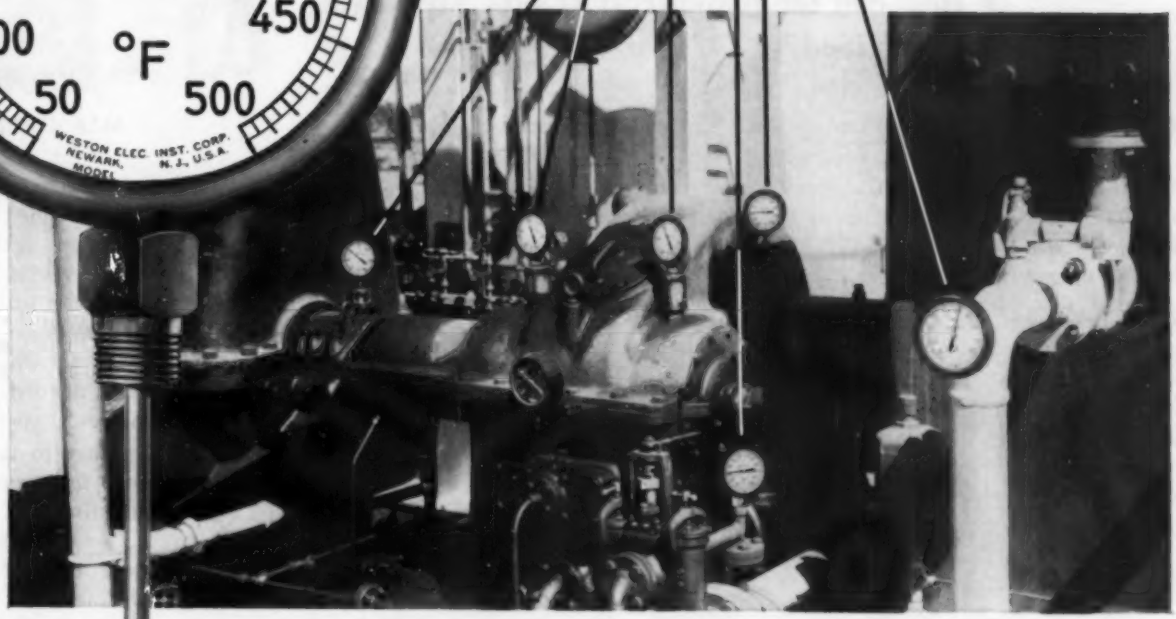


Fig. 6—Sleeve-bearing totally-enclosed fan-cooled squirrel-cage polyphase induction motor for use in hazardous gas location, Class 1. Terminal-box-side view, oblique, drive end at right.

# AT EVERY CHECKPOINT



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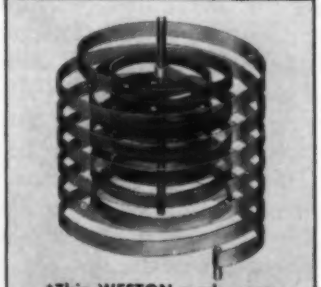

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# You Asked About Corrosion . . .

MARSHALL E. PARKER

- **Is it worthwhile to sectionalize a line by insulating block gates, etc.?**
- **How can the higher cost of superior coating be justified?**

**By MARSHALL E. PARKER,** Consulting Corrosion Engineer

**Q.—The importance of insulating a pipe line from station structures, tank farms, and the like, is recognized; is it worthwhile to sectionalize the line itself by insulating block gates etc.? R. P. H.**

**A.**—The obvious answer to this is: it is a relatively easy and inexpensive matter to install insulating material in a flanged joint at the time of construction, and an exceedingly difficult and expensive matter to install it once a line is in operation; and, if it turns out that a joint need not have been insulated in the first place, it is a very simple thing to short-circuit it; therefore, if there is any possibility at all that insulation might be needed in a main-line joint, it should be specified and installed on original construction.

Ordinarily, a well-coated line may easily be placed under cathodic protection by working with sections between pump or compressor stations as units; if the coating is very good, usually one unit per section will suffice. Even if more than one unit is needed for each section, there is seldom any valid reason for sectionalizing insulation in operation. However, both of these statements are based on the assumption that everything goes as planned; that there are no short-circuited casings, or shorts to crossing lines; that there are no tie-ins which are inadvertently not insulated; and that there are no major coating failures or damages. If any of these unforeseen accidents occur, then there is first the problem of locating and diagnosing the trouble, and, second, the problem of doing something about it.

An ideal situation exists when *all* main-line flanged joints (except where two or three occur at a single location) are insulated. Then, when the cathodic protection system is designed and installed, short-circuiting bonds will be placed across all of these which lie between stations. The best results are obtained if these bonds take the form of calibrated shunts, so that current flow along the line can be measured without opening the circuit. With an arrangement of this kind, as soon as there is any indication of a failure, the section whose current demand is excessive can be quickly and readily located. If the trouble is one which is easily remediable, the proper steps can be taken, the contact cleared, and normal operations resumed.

If, however, the difficulty is short-circuited casing, or a major coating failure, or a short-circuited river clamp; if it is some change in the physical environment of a section of the line which cannot be easily cleared, then there is always the possibility of segregating the section in trouble from the remainder of the line, and then designing and installing for it a separate cathodic protection system which fits its particular needs.

The whole question may be summed up by the statement that an insulated joint, where none is needed, is never a problem; it can always be shorted: but a conducting joint, where insulation is needed, is always a problem, and one which is difficult and expensive to solve.

**Q.—I see statements in the literature to the effect that even a very mediocre (and hence inexpensive) coating will be 98 percent to 99 percent effective, and that the cost of complete cathodic protection on a line so coated is far less than the difference which would have to be paid for superior coatings; if this is true, how can the high cost of superior coating be justified? S. D. H.**

**A.**—This question points up a difference of opinion which has been developing, within the last few years, almost into the dimensions of a controversy. There are valid arguments on both sides, and the final answer is not in as yet. Briefly, the two positions may be summarized as follows:

**1.** No known coating is good enough to entirely eliminate the need for cathodic protection. Therefore the corrosion control program for a given (contemplated) pipe line should employ that combination of coating and cathodic protection which will give complete protection at a minimum total annual cost, taking into account amortization and recognized accounting procedures. It is claimed that this minimum total annual cost is reached with a low-cost coating and a considerable amount of cathodic protection.

**2.** The coating applied to a newly constructed line should be of the highest quality, and should be given meticulous inspection. This will result in a line whose current demands for complete cathodic protection are very low; the resulting freedom of design, and reliability of operation will justify the higher total cost.

Both of these positions have merit; the choice between them seems to rest on some conditions external to the line under consideration. Where the line is isolated, and can be expected to remain so, there seems little quarrel to be made with the first opinion stated. The total annual cost for complete protection *is* less with a medium-priced coating job and all the cathodic protection needed. This is true only if the protective system is adequately maintained, so that it functions all of the time.

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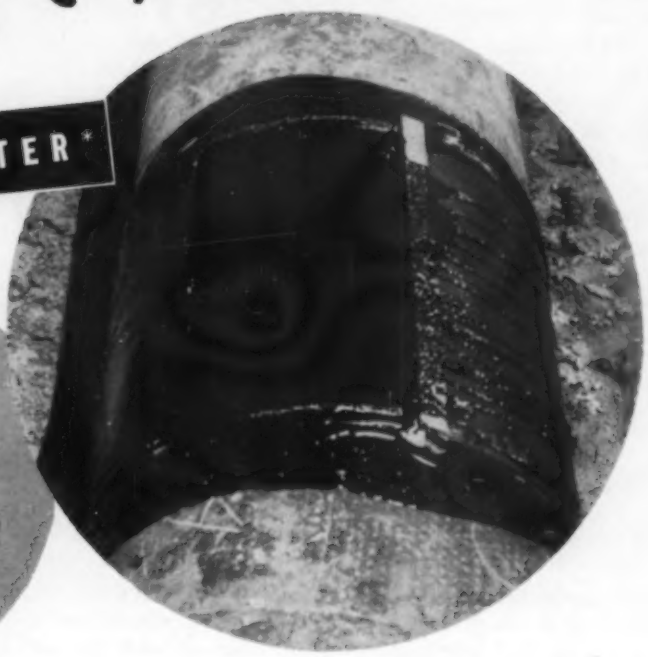

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**Inexperienced labor can effectively apply these Fieldjointers. Two men can usually coat the field joints on small and medium sized pipe in a mile section in one day. Fieldjointers are available for pipe from 1" to 36" in diameter.**

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or with only minor interruptions. This means frequent surveys and inspections of the system and its performance.

The full import of the differences between the two proposed schemes can only be had by an examination of the magnitude of the differences between them. In the first case, the coating will probably be about 98 percent effective; for a 12-inch line, for example, this will mean a distributed current demand of about 1 ampere per mile. Taking into account the necessary over-protection in the vicinity of a drainage point, a likely design for this line would include a 30-ampere rectifier every 20 miles. With superior coatings, an effectiveness of 99.9 percent is not uncommon. For the same line, this means a distributed current demand of about 0.05 ampere per mile; protection could easily be obtained with a 5-ampere unit every 40 miles.

A rectifier spacing of 20 miles means necessarily that many of the units will be at isolated locations; a 40-mile spacing (and it can easily be increased) could mean that all of the units would be installed at pump or compressor stations—at locations which are continuously manned, so that daily meter readings could be taken at no added cost. Obviously a system which can be easily and cheaply inspected is likely to be better inspected than one which requires special trips.

Furthermore, a system which requires the installation of 5- or 10-ampere units is not nearly so dependent upon available soil resistivities; even under unfavorable conditions, it is not too expensive to install a low capacity ground bed. And a system calling for 40-mile spacing is not so dependent upon available power lines as one which requires 20-mile spacing.

It is also true that a line whose current demands are very low is much more sensitive to minor disturbances; this means that any accidental short-circuit with a crossing line, or any failure of an insulated joint, or even any mechanical damage to the coating, will make itself known immediately by a sharp drop in pipe/soil potential, or perhaps even by an increase in unit current output. It is therefore easier to maintain the quality of a high-quality coating than that of a mediocre one; provided, always, that the system is adequately supervised and inspected.

But the biggest advantage of the superior coating, low-current-demand line accrues when it has neighbors; when there are crossing or parallel lines, or when congested urban or suburban areas with many underground structures are traversed. Rectifier installations with a total current output of 5 or 10 amperes, especially when they are at an average spacing of 40 miles or more, can easily be kept far enough from foreign structures to avoid any danger of interference with them. Still more important is the low current density in the vicinity of the protected pipe itself; when it is of the order of 0.05 to 0.1 ampere per mile, there is seldom any damaging pickup and discharge by other structures, even when they parallel the protected line for miles.

The end result of this state of affairs is that the line whose current demand is so low as to call for 5-ampere units may, in exceptionally bad cases, have to have some 10-ampere units, with directional drainage bonds; while the line which needs 1 or 2 amperes per mile may have to be supplied with twice as much, in order to satisfy the requirements of the many bonds needed; and, in addition, the line with large current demands may require weeks of expensive engineering time in locating the points of interference and providing the necessary remedial measures. The only alternative is that of blandly ignoring the engineer's fundamental responsibility to others, and simply letting the owners of the other lines look out for their own interests. This way lies chaos, and so far corrosion engineers in general have refused to shirk their responsibilities in this regard.

## Motor Performance

*Continued from Page 80*

some cases power is purchased at utilization voltage. In this case, there is no choice, however, when power is purchased at the primary distribution voltage the economies of all available utilization voltage level systems should be investigated. Motors in the range from 350 to 3500 horsepower are readily available in either the 2300 or 4000 volt class.

Therefore, if the station is to be a large one, or if future expansion is indicated, the interrupting rating of readily available switchgear should be reviewed as a factor in choosing the motor voltage. For example, on a large power system (1000 mva short circuit available), a 5000-kva, 2400-volt substation is a limiting size with switchgear which has a 40,000-ampere momentary duty. (Momentary rating of a breaker is the total maximum current which it can withstand. It is an indication of its mechanical strength.) For the same conditions and using switchgear with the same momentary rating, a 9000-kva, 4160-volt substation is the limiting size. If heavy-duty switchgear is used, that is, switchgear with a 60,000-ampere momentary rating, these limits are increased to approximately 7500 kva at 2300 volts and 12,000 kva at 4160 volts. With the present trend to larger stations, this factor should not be neglected in considering the motor voltage.

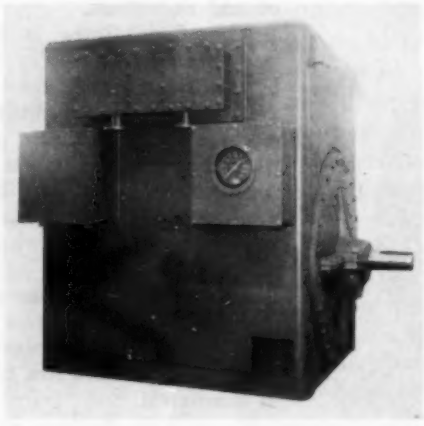

**Fig. 7**—Total enclosed inert gas filled squirrel cage induction motor with cooler (inert gas to water heat exchanger, top; middle), rated: 3000 hp at 1800 rpm. Accessories shown: motor main lead conduit bar at left; inert gas low-pressure alarm at right; sight gage at bottom. Bearing forced-feed oil lubrication system, pump and piping not shown. View from shaft end.

At times some confusion is encountered concerning the designation of voltage level. When speaking of motors or other utilization equipment, the proper designation is 2300 or 4000 volts. When speaking of transformers or other distribution equipment, the correct designation is 2400 or 4160 volts.

**(TO BE CONTINUED)**

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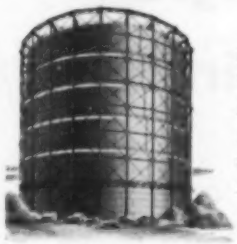

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A section of the 24-inch loading line near Muturi Hill.

# 50-Mile Jungle Pipe Line Completed in New Guinea

**• The isolated oil fields of Wasian and Mogoi are now connected with the coast.**

**• The last 6½ miles of this line is supported by a special trestle above the jungle floor.**

THE COMPLETION of the largest oil pipe line in Netherlands New Guinea has connected the jungle-surrounded oil fields of Wasian and Mogoi with the coast, over 50 miles away. The project involved the construction of a pipe line trestle over 6½ miles of swamp.

Netherlands New Guinea is a relatively new member of the world's oil-producing countries. The first cargo of crude was exported in December, 1948, but exploration began as long ago as 1935 in the Vogelkop sector, on the northwest side of the island.

After extensive aerial mapping, necessary because of the inaccessibility of the region, the area was investigated by field geologists and geophysicists. In the West Vogelkop district, oil was first struck in a test well at Klamono in October, 1936. In East Vogelkop the first productive wells were completed at Wasian in June, 1939; and at Mogoi, in the middle of 1941.

The time taken to achieve commercial production is itself a measure of the intense difficulties which had to be overcome. The operations in New Guinea have been complicated by severe tropical conditions including jungle, swamp and torrential rain. The already large financial outlay incurred in the exploration and production of the oil has been greatly increased by the cost of forging communication links over such impassable terrain.

The operating company is the Nederlandsche Nieuw Guinee Petroleum Maatschappij, owned by N. V. de Bataafsche Petroleum Maatschappij (Royal Dutch/Shell Group), Standard Vacuum Oil Company, and Far Pacific Investments, Inc.

During the war operations were suspended, but in the postwar years a 30-mile road and pipe line were built from the Klamono field—developed meanwhile—to an outlet ocean terminal at Sorong. The field is now producing 750 tons of crude oil daily.

The next step was to provide an export outlet to a marine terminal on

**Part of the trestle which was specially built to carry the 24-inch pipe line over the swampy country between Muturi Hill and the marine terminal.**

the River Muturi for oil from the Wasian and Mogoi fields, now producing at a joint rate of 1300 tons daily. This was difficult because the route ran through the swampy territory of the River Muturi areas and over the uneven Tembuni range of hills.

The first stage of the project involved the laying of six-inch pipe lines from Wasian and Mogoi to a junction at Tembuni. Here two storage tanks, each 3000-ton capacity, and a pump house were built. From Tembuni an eight-inch line, some 37 miles long, was laid to Muturi Hill, 330 feet high, where two more storage tanks of 22,000-ton capacity, were built. A 24-inch line was laid for gravity loading along the ten miles from Muturi Hill to the terminal. The last stretch of coastal swamp, 6½ miles long, had to be crossed by a specially constructed pipe line trestle.

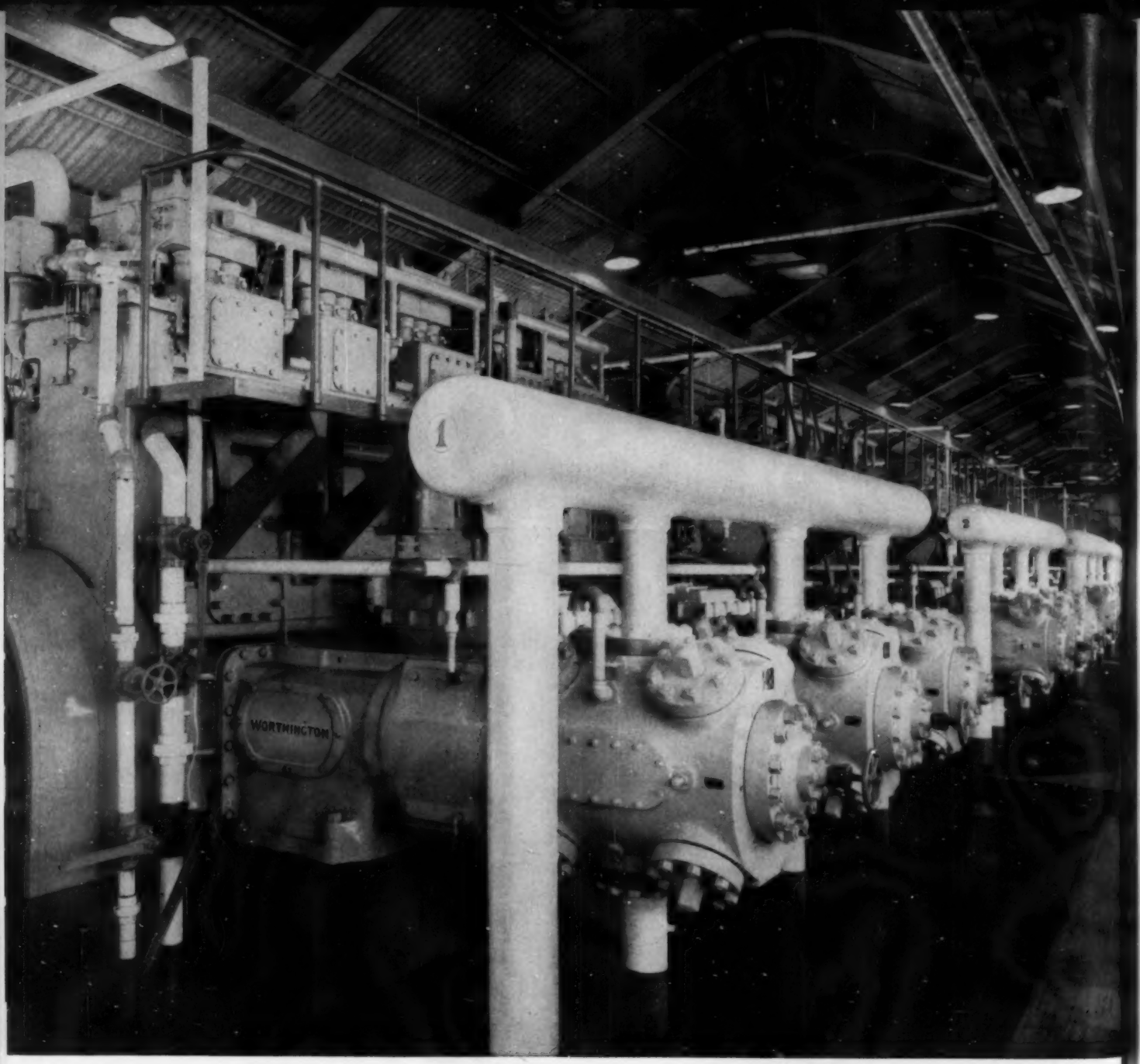
Almost all the materials for the entire project were manufactured in Holland, shipped to East Vogelkop and assembled there. Some 500 Papuan workers and 160 Dutch technicians worked on the venture over 18 months. **—The End**

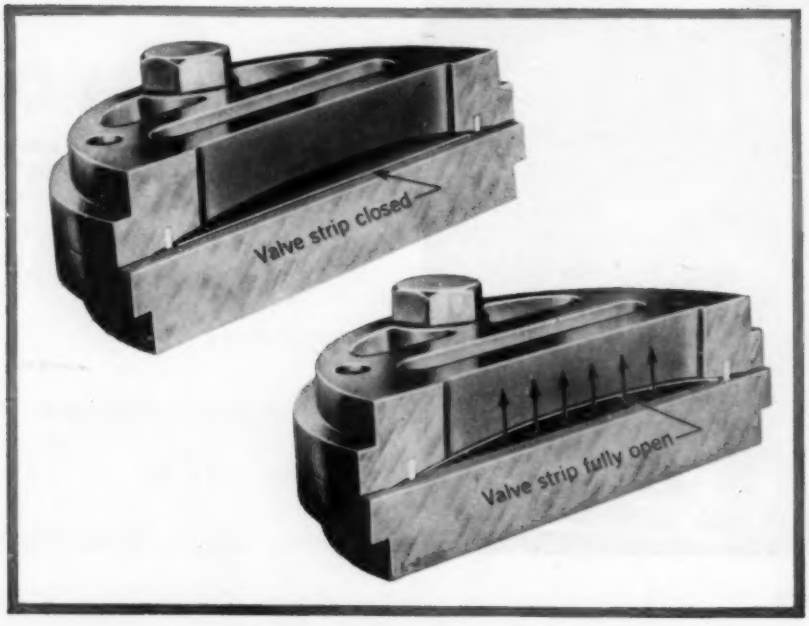
ACKNOWLEDGMENT

Reprinted from *The Shell Magazine*, June, 1954.

**A section of the 6½ miles of pipe line trestle crossing the swampland.**

***Photographs by Shell***




**10,000 HORSEPOWER IS DELIVERED** by these ten Worthington UTC Engine-Compressors in the Navajo Station on the El Paso Natural Gas line. Two 2000-hp Worthington UTC compressors are planned for the company's pending expansion at this station. They will handle a total of 687,000,000 cubic feet of gas when the installation is completed.

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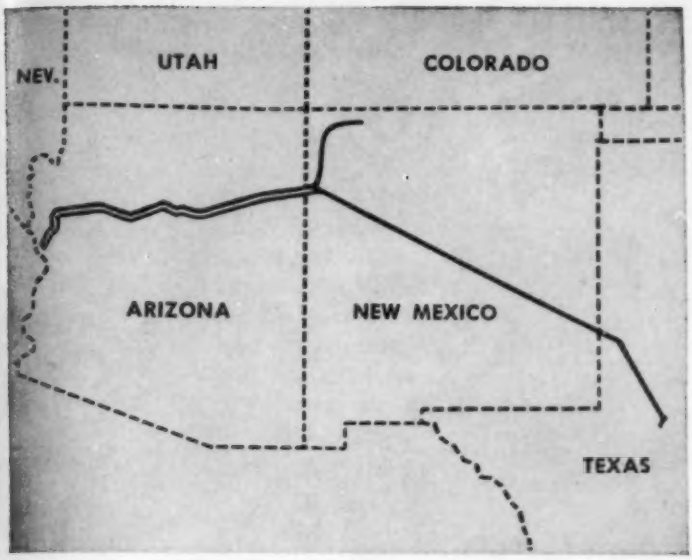
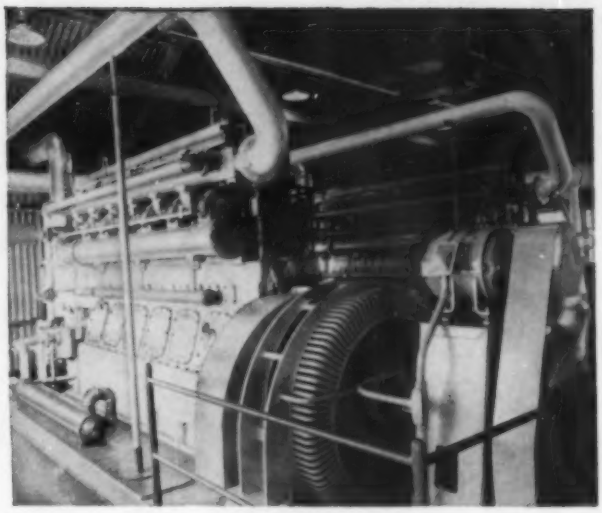



**PROPOSED 792 MILE, 30" PIPELINE** to add 400 million foot capacity will run from the Permian Basin in Texas to Franconia, Arizona. The Navajo Station, largest in the line, will use a total of thirteen Worthington UTC Engine-Compressors.



**ELECTRIC POWER** for the Navajo compressor station is supplied by these two Worthington type CCG-6 gas engines which drive Electric Machinery generators. Such an economical means of generating power should not be overlooked when compressor stations are planned. Another CCG-6 is planned to supply additional power at the Navajo Station.

# 13 Worthington UTC Engine-Compressors planned for new El Paso Natural Gas line

The El Paso Natural Gas Company plans to install 13 Worthington Uniflo two-cycle engine-compressors on its new 792-mile line if the project is approved by the Federal Power Commission. These are in addition to the 18 units that the company already has in operation or in process of installation on this line.

The new 30-inch main transmission line will originate in the Permian Basin and extend in a northwesterly direction across New Mexico to a point near Gallup. There junction will be made with the existing 24-inch main transmission pipe line from the San Juan Basin. From that point west, the new 30-inch line will loop the present San Juan line to a point close to Franconia, Arizona, near the California border. This line will make possible additional deliveries totaling 400 million cubic feet of gas per day; 300 million cubic feet per day coming from the Permian Basin and 100 million cubic feet per day from the San Juan Basin.

The Navajo and Leupp compressor stations, first and second to handle the full 687 million cubic feet per day (the San Juan system is currently authorized for 287 million cubic feet per day) are both fully equipped with Worthington UTC Engine-Compressors exclusively.

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# Dehydration of Light Hydrocarbon Liquids

Part 1: Dehydration methods

**Part 2: Regeneration methods and design factors**

Part 3: Distillation drying and testing for water content

**By JOHN M. CAMPBELL,** Assistant Professor Petroleum Engineering, University of Oklahoma, Norman, Okla.

Part 1, page 54, October, 1954 PLI

THE CHIEF DIFFERENCE among the various plants lies in the means of regeneration. In each case it is necessary to supply a source of heat and a means of removing the water vaporized. When dehydrating relatively non-volatile and/or fluids whose composition changes, it is common to supply the regeneration energy from an outside source, such as steam or hot natural gas. With very volatile liquids, such as propane and butane, use of that liquid for regeneration usually shows favorable economics.

Regardless of the system used, the charge existing in the towers at the start of the regeneration cycle must be drained. This may be accomplished with a pump, gravity drainage or using the regeneration gas as the motivating force. The holdup stock thus obtained is usually either returned to the raw feed inlet, a "slop" tank or is vaporized for regeneration.

It has been customary in product pipe line service, to bypass the plant when an interface was passing. However, in at least one instance it was found that the amount of interface increased only 9 percent when allowed to pass through the tower.[7]

## CLOSED VAPOR SYSTEM

The closed vapor system shown in Figure 3 (see Part I, page 53, October, 1954 PLI) is typical of many used for propane, but is only one of several approaches.

At the end of the drying cycle the pump is started, which serves to furnish regeneration gas and in turn displaces the holdup stock. During this period the holdup stock is the chief source of gas.

The hot exit regeneration gas flows to a condenser where all water formed is discarded in the knockout. The wet propane then returns to pump suction. Any additional propane needed is supplied from the wet feed.

On the cooling portion of the cycle a portion of the dry exit stream is used, to prevent resaturation of the desiccant. This is pumped through the towers, into the condenser and back to the pump, by-passing the knockout and heater. When switching back to the drying cycle the tower in question is full of dry propane and does not have to be filled.

**Open vapor-inert gas system.** The type of plant shown in Figure 4 (see

may use super heated steam, natural gas, flue gas or any inert gas, the choice depending upon the availability and the relative cost. When the dehydration facilities are installed in conjunction with large plants, where excess quantities of super heated steam are available, it is often the cheapest medium to use. However, close control is necessary to prevent rehydration of the desiccant bed. It is interesting to note that when both saturated and super heated steam are available, the use of saturated steam in the so-called closed steam system usually shows favorable economics. The discussion of this system follows later.

When using steam as a regenerating medium rehydration of desiccant can offer serious disadvantage. Although the evidence is not conclusive, there are indications that the mono-hydrate of alumina is formed, which has a very low efficiency when compared to the trihydrate, normally present in the activated material.

The use of natural gas is quite common, since it is usually available under pressure in relative large quantities. However, its use does not show as much economic advantage as the price continues to rise, unless the wet residue gas may be introduced back into a natural gas system. In refineries the use of flue gas is normally a very satisfactory approach.

The gas to be used for regeneration is normally heated to 400-500° F. in either a direct fired or a salt bath heater. After passing either upward or downward through the bed, wet gas enters a condenser, at which point non-condensable vapors are vented to the atmosphere or recompressed and recycled. The water and liquid hydrocarbons obtained in the condenser are usually sent to the drain.

The cycle is continued until the exit gas temperature reaches 325-375° F., the temperature necessary being a function of the liquid being dried and the tower pressure. In general, the heavier the material being dried, the higher the regeneration temperature needed. When drying heavy fuel oils for example, 450° F. is usually desirable, whereas 400° F. is normally adequate for gasoline. The absorbed water is normally vaporized at much lower temperatures but temperatures of this degree are necessary to remove the absorbed hydrocarbons in

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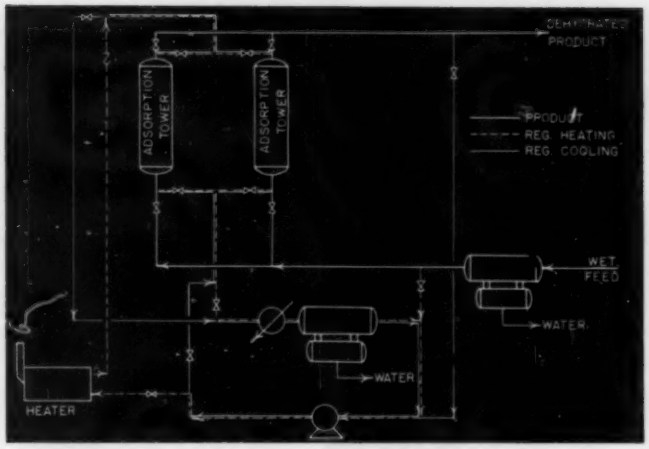



Fig. 3—Flow diagram for a closed vapor system.

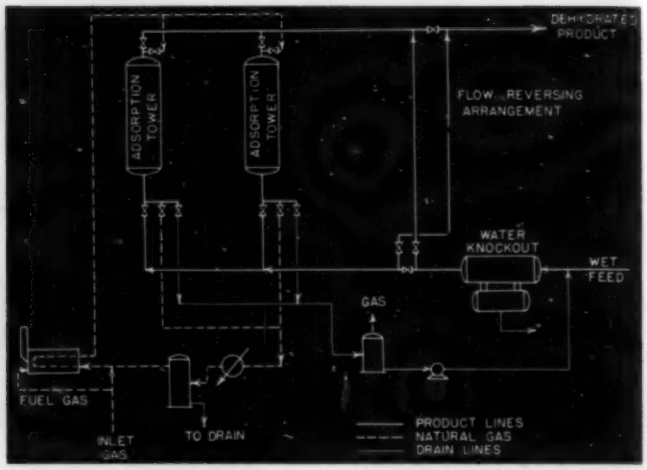



Fig. 4—Flow diagram for a natural gas system.

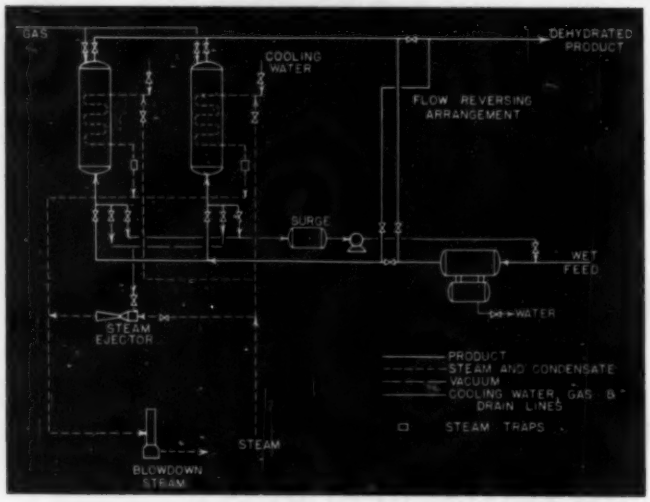



Fig. 5—Flow diagram for a closed steam system.

**These illustrations repeated from Part 1 of this article, which appeared in the October, 1954, issue of PLI.**

order that water absorption will be more efficient during the early part of the drying cycle.

It is desirable that the regeneration gas be insoluble in the liquid being dried. Naphtha, for example, may be used but it tends to cause contamination of the product by absorption in the holdup stock.

With this system, the cooling of the desiccant is normally accomplished by bypassing the regeneration gas around the heater. Although cycle time sometimes limits the degree of cooling, it is desirable that the bed temperature be not over 125° F. when placed on the drying cycle.

**Closed Steam System.** If the heat balance in the plant indicates the desirability of using steam as a regeneration medium, the closed system normally shows advantage. The initial cost is somewhat higher because of the necessity of embedding coils in the desiccant bed, but greater heat may be derived per pound of steam circulated. The use of saturated steam also has the advantage of reducing contamination in the holdup stock and reducing the safety hazard around the plant.

When using steam, in the closed system, it is necessary to furnish some means of removing the water vapor formed in the bed. This may be accomplished either by using relatively small quantities of purge gas or by pulling a vacuum on the bed proper. The latter is most common, the vacuum being continued until the pressure reaches 25-27 inches of mercury, after the desired regeneration temperature has been obtained. The vacuum needed is normally supplied by means of an ejector, using either steam or natural gas. The resultant vapors are normally vented, any liquid obtained going to the drain.

Caution is necessary when reducing the pressure on the bed, in this or any other system. If the pressure reduction is too sharp, there is a tendency for the desiccant to fracture and in effect explode, because of the rapid evolution of water from the inner pores. In some plants, substantial quantities of desiccant have been lost through such powdering in conjunction with a rapid "blowdown."

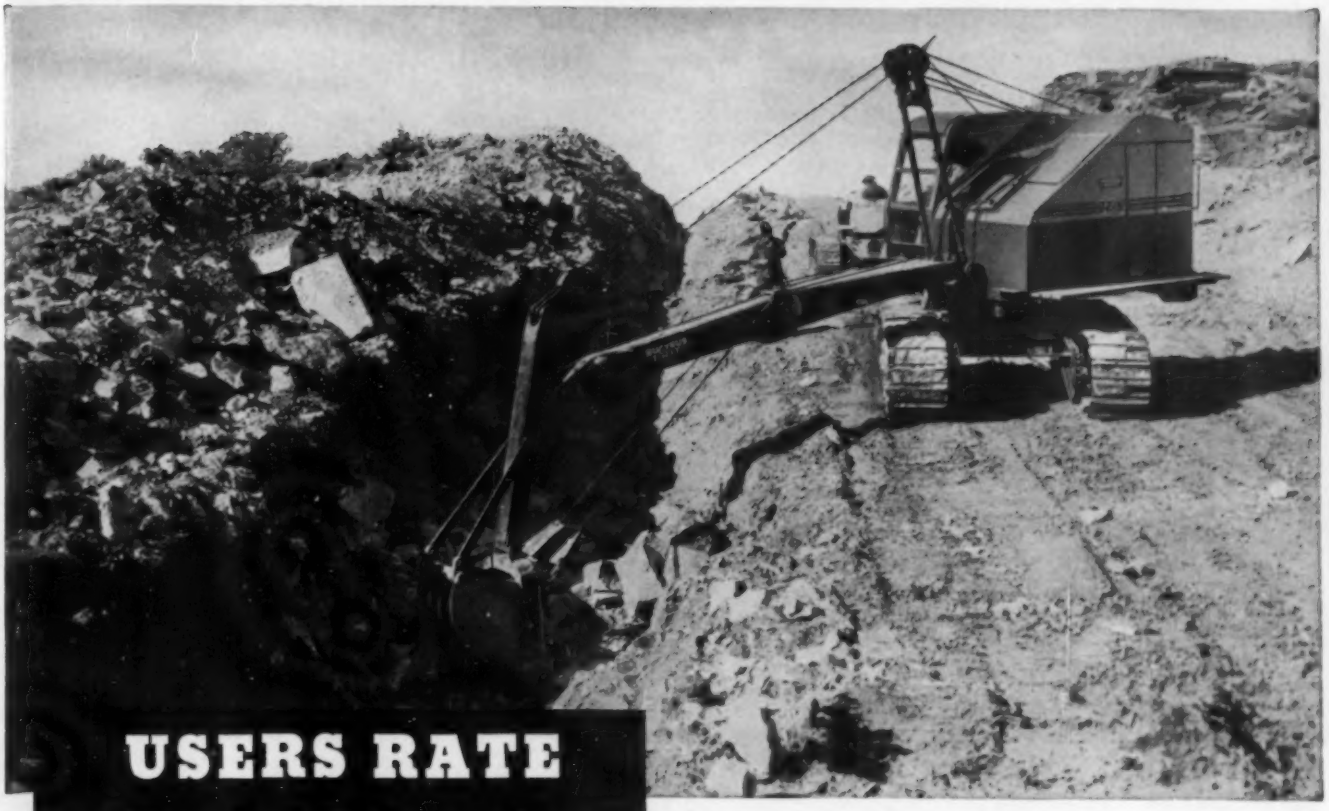
The use of a vacuum offers an advantage in that lower regeneration temperatures are possible. With the average fluid present in products pine line service, 350° F. is normally necessary, which requires about 150 pounds per square inch gauge steam. With the very light fluids, as mentioned above, lower temperatures are possible though.

It is possible to design the coil using standard heat transfer formula and other data available on packed beds.[9] From existing plant data, using 150-175 psig saturated steam, it has been found that about one square foot of coil surface for each 5-8 pounds of desiccant has been satisfactory. This figure serves as a satisfactory rule of thumb.

## DESIGN FACTORS

**Amount of Water To Be Removed.** The amount of water to be removed is obviously dependent upon the fluid, the service and any test specifications that might apply. Propane, for example, is normally dried so that the vapor from the dehydrated fluid is negative to the Cobalt Bromide Test.[10] In product pine line service, it is customary to dehydrate the liquid only to the point where the saturation temperature is below the "low line temperature." Therefore, it is necessary, in many cases, to remove only 50-70 percent of the water to satisfy process requirements.

From a design standpoint, however, it is usually desirable to assume that



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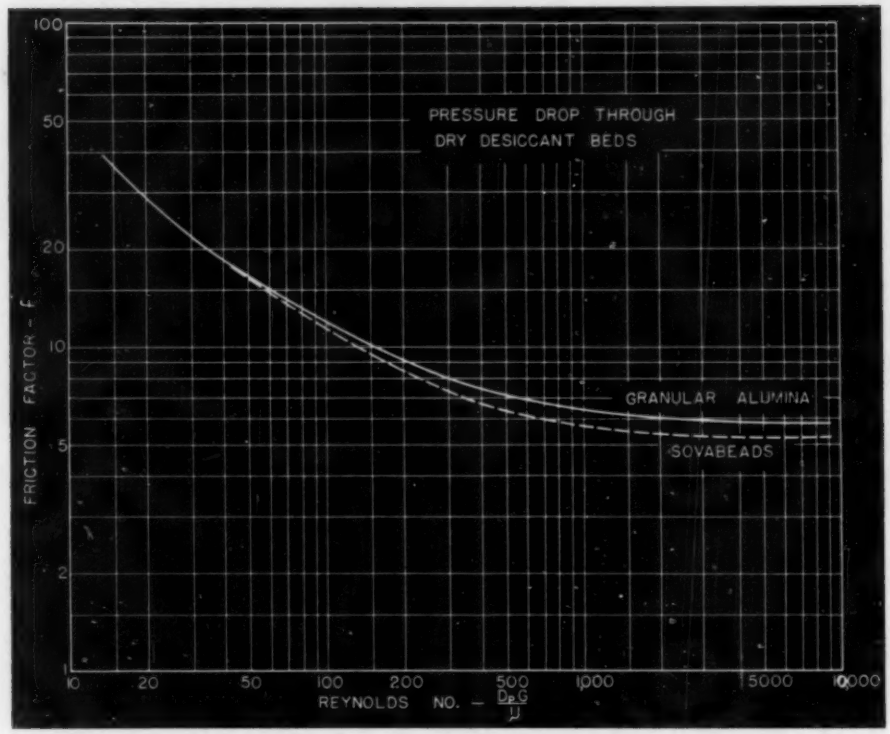



**Fig. 6**—Pressure drop through granular beds.

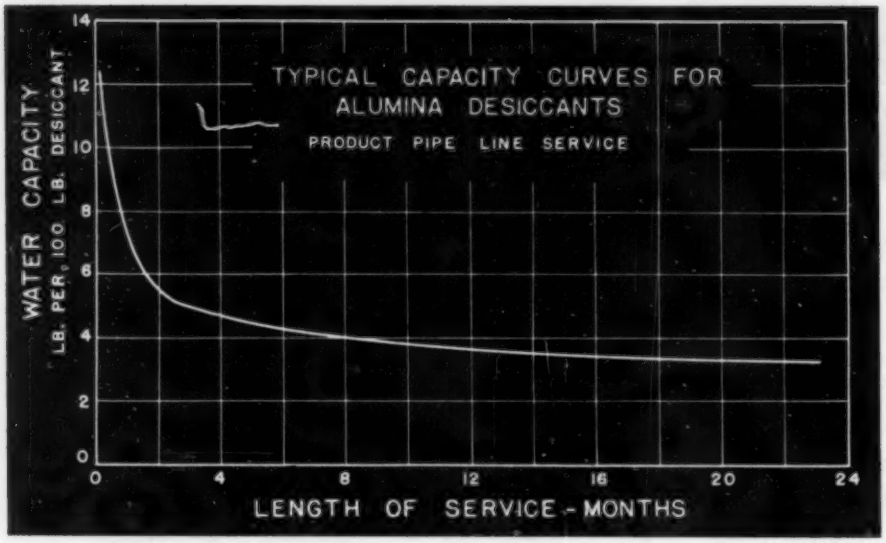



**Fig. 7**—Typical alumina desiccant adsorption capacity.

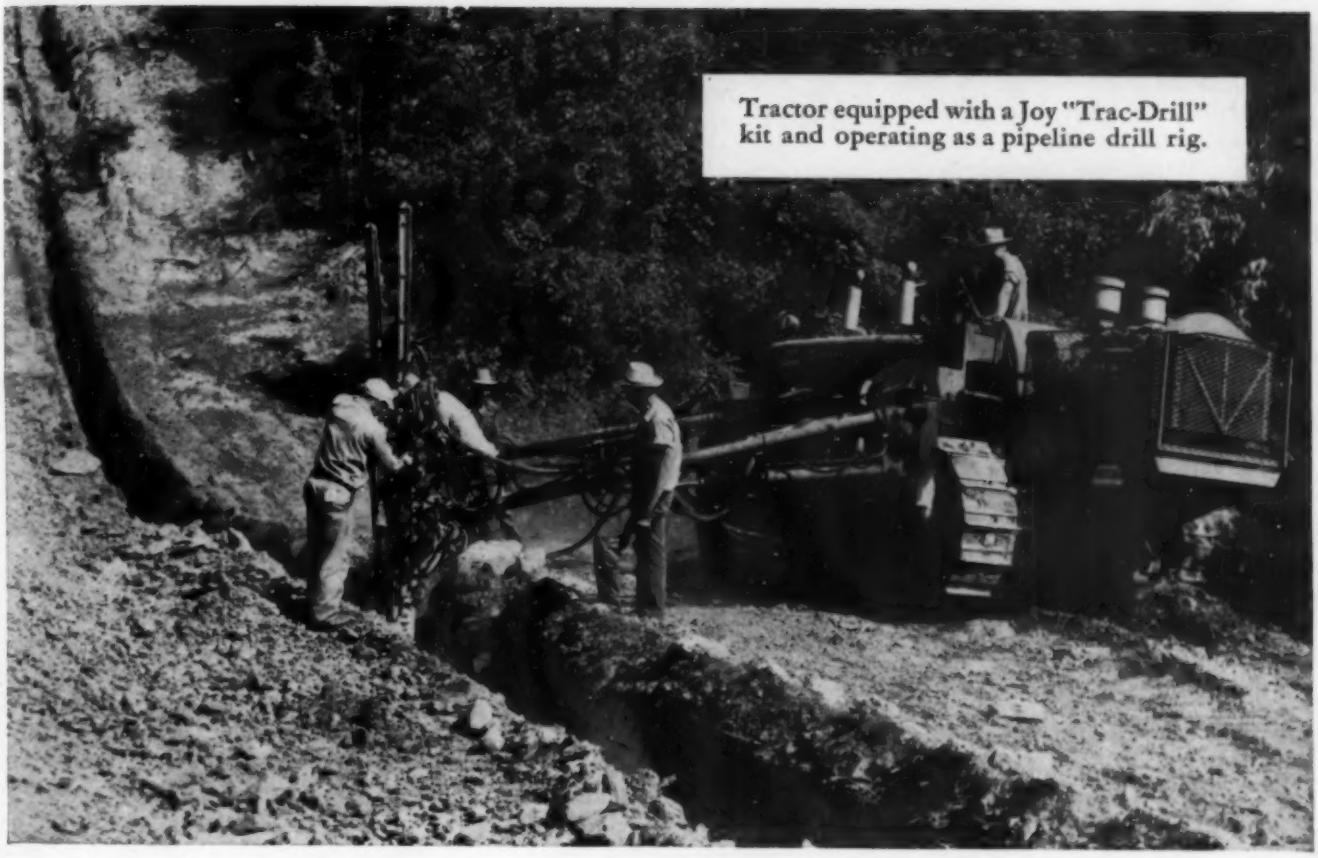
all of the incoming water will be removed in the desiccant bed, in determining the volume of desiccant needed. This evolves somewhat from practical reasons because on contact with a freshly regenerated tower substantially all the water is actually removed. In other words, no positive control over the outlet water content is possible unless one of the multiple tower schemes outlined previously is used, except when certain quantities of liquids are bypassed. In actual operation, the exit dew point is quite low until the break point is reached, at which time the exit water content increases. The over-all composite water content might be very near to the average desired, but since there is little mixing and the cycle takes place over a period of hours, this has no great significance in pine line systems. Of course, if the liquid is going to a tank, this approach would be entirely satisfactory.

The previously discussed solubility curves shown in Figure 2 (see Page 53, October, 1954, PLI) may be used to estimate the amount of water that needs to be removed. A natural discrepancy in solubility data though makes it necessary to consider such curves only as approximations. They do serve, however, to determine the general slope of lines when only one or more data points are available. Particular care must be used with curves for gasoline, since the water content varies markedly with the method of manufacture.

Several attempts to develop general water solubility correlations have been made.[15] Griswold and Kasch[10] have attempted to correlate the solubility data into two curves, one for paraffinic and one for aromatic hydrocarbons. The accuracy claimed is 18° F. so that their use can give only approximate results. Although many materials, particularly the gasolines, will often fall somewhere in between the two curves, these curves are useful to extrapolate data where only one or two points are available. Kobayashi, McKetta and Katz have also made detailed studies of two- and three-phase systems which will be found particularly applicable for distillation drying.[13,15] A correlation similar to that of Griswold and Kasch has been made based on molecular weight[4] although molar specific volume appears to give more accurate results.[13,15]

**Sizing of Towers.** The primary variables in sizing towers are the allowable liquid velocity, the minimum liquid-desiccant contact time, the amount of desiccant needed, and the pressure drop. After the amount of water to be removed is known, it is customary to determine tower diameter as determined from limiting velocities. Once this diameter is known, it is simply a matter of dividing volume by the diameter to obtain the depth of bed necessary, to give the required amount of desiccant. It is then further necessary to see if the combination of the depth and velocity gives sufficient contact time. If not, which is unusual, a longer tower is necessary.

The allowable velocity through the bed of course varies with pressure drop considerations, but is usually of the order of 2-5 feet per minute, based on the free cross-sectional area. At these rates pressure drop and desiccant breakage is low, and fabrication of the towers is economical. In order to obtain efficient liquid desiccant contact and to minimize channeling, it is felt advisable to have a minimum of five feet of desiccant bed



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available in the tower. Equilibrium laboratory investigations have shown that as little as three seconds contact time is sufficient, but the average plant installation provides 2-3 minutes of contact. With these considerations the tower length to diameter ratio is normally 2-3 to 1.

The pressure drop through a given granular bed can be estimated from Figure 6, which is a general correlation for fluids in such granular beds. This curve and its limitations have been discussed in a previous article.[24]

The equation to use with Figure 6 is:

$$\Delta P = 0.0139 \frac{fLG^2}{Dpg\rho}$$

Where:

$\Theta$ = 32.2 ft./sec.$^2$

L = depth of desiccant bed—ft.

f = dimensionless friction factor

$\rho$ = fluid density, lb./ft.$^3$

$\mu$ = fluid viscosity, lb./ft.—sec.

G = fluid mass velocity, lb./sec./ft.$^2$

$$= \frac{60}{V\rho}$$

$\Delta P$ = pressure drop, psi.

V = gas velocity, ft./min.

$D_p$ = effective particle diameter, ft. (Obtained from desiccant screen analysis)

The volume of desiccant needed is obviously dependent on the amount of desiccant needed to adsorb and hold a unit weight of water. An estimation of aluminia adsorptive capacity may be obtained from Figure 7. When new, the aluminia desiccant is capable of adsorbing about 12-14# of water per 100# of desiccant, but the capacity diminishes rapidly during the early service life and levels out at a capacity usually between 2 and 4 percent. The curve shown is typical, but some variations are noted because of the differences in regeneration practice, variations in the material being dried, and the general design of the equipment. In the average case however, 2-3 percent is customary in order to provide a reasonable desiccant life.

**Regeneration Requirements.** The amount of heat required for regeneration is subject to the same considerations as with natural gas.[24] The heat load though is normally less because of the smaller volume of water absorbed per cycle and the smaller vessels. A heat balance is necessary in order to size the regeneration heater and the following must be included:

1. Sensible heat to heat the water from the drying to the regeneration temperature.
2. Latent heat of vaporation and heat of desorption of the water.
3. Sensible heat of the desiccant bed.
4. Sensible heat of the tower shell.
5. Heat losses (about 5-10 percent).
6. Sensible heat of vaporization and heat of desorption of the adsorbed hydrocarbon liquid.

The last item varies with the material being dried and the internal porosity of the desiccant. However, most desiccants have an internal porosity of about 25 percent, so to be safe, it is customary to use this figure times the vessel volume, which in effect provides a safety factor in this calculation. It is safe to use a figure of 1100 BTU/pound as a summation of the latent heat of vaporization and the heat of desorption for water. All other figures necessary may be obtained from standard data.

In actual regeneration, the majority of the water is vaporized when the temperature reaches 250° F. Therefore, most of the water is vaporized during only one hour of the regeneration cycle. Consequently, it is advisable to determine the heat load during that particular hour to size the regeneration heater, since the heat load obviously varies throughout the cycle. Dividing the total heat load by the number of hours of regeneration to obtain the BTU/hour therefore does not give a true picture of the hourly heat load.

**Cycle Length.** The cycle length is contingent on the flow rate, percentage of liquid saturation, condition of the desiccant, the product being processed, and the amount of water to be removed. The cycle length though is usually either 12, 24, 36, or 48 hours in length, with 24 hours being the most common. This latter cycle reduces the operational attention without requiring large towers.

**Free Water Knockout** The design of the free water knockout is every bit as critical as that of the sorbers proper. In many plants test data have shown that the actual quantity of water entering the desiccant beds is about twice the quantity at equilibrium. This experience stems not so much from errors in equilibrium data but from inefficiencies in the free water knockout proper.

The problem in the free water knockout is not only to have sufficient settling time, so that the water and hydrocarbon phase may separate, but to prevent entrainment of water droplets overhead into the liquid stream. In designing such a free water knockout, the important factor is not the liquid load but the effective water velocity across the oil-water interface. In other words, the larger the surface through which water may diffuse, the more efficient the separation.

The holding time is of course important in order that the water has time to settle. It is therefore advisable to make the free water knockout large enough to hold two to three hours production. The allowable design velocity across the interface is a function of the density of the hydrocarbon liquid being handled, the higher the hydrocarbon density, the lower being the velocity that is allowable. In the presence of heavy oils a velocity of 40 feet per hour has proven satisfactory, whereas with propane grade liquids 60-80 feet per hour has sometimes been used. In order to be doubly safe, some designers use an overall figure of 20 feet per hour for all fluids. Because of these low velocities a horizontal vessel offers the greatest separation capacity per unit volume.

It is the opinion of the writer that some coalescing element in the free water knockout is desirable. The ease of separation increases with the size of the water particles and this device is simply one to coalesce small water droplets into larger ones before entering the settling section proper. This also reduces entrainment since such a loss is more prevalent when the water droplets are very finely dispersed throughout the oil. The problem becomes particularly critical with gel-type desiccants which are subject to fracturing in the presence of liquid water.

Regardless of the design of the free water knockout it is felt advisable to assume that 1.25 times the equilibrium quanity of water will go to the desiccant beds. By this means, a reasonable factor of safety is provided without unduly increasing the size of the beds proper. **—End Part 2**

A complete bibliography was published with Part 1 (October, 1954, PLI).

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**The Best Way To Convince A Man** of anything is to let him prove it to himself! That's why we are willing to send you a sample 3-Ft. Tuffy Sling, absolutely *free*. There's nothing to buy, no obligation of any kind!

**"Torture Test" This Sling** and see for yourself how its patented, machine-braided wire fabric construction enables it to stand up under conditions that would cause ordinary rope slings to fail.

**Loop It, Knot It, Kink It, Jerk It!** Put this Tuffy Sling to the most grueling tests you can think of! When you see how its extra flexibility lets it resist kinking, its ease of straightening out kinks without material damage, and its unparalleled stamina under stresses and strains of all kinds—then we know you'll be convinced that Tuffy is the *toughest* in the business!

## Your Tuffy Distributor is Set Up For Speedy Service!

**"Fast!"** That's the word your Tuffy distributor is accustomed to hearing. He knows how important it is to get you the replacement slings and rope you want, *when* you want it. He's equipped to handle your hurry-up orders and there's a Union Wire depot or warehouse nearby to back him up. For "right now" delivery, call your *Tuffy* distributor!

**union** *Wire Rope* **corp.**

*Specialists in High Carbon Wire, Wire Rope and Braided Wire Fabric*

## Tuffy® HOIST LINE

**Matches Tuffy Slings** in strength and wearability . . . stays on the job longer to reduce operating costs! Users consistently report Tuffy Hoist Line is the best they've ever used when it comes to flexibility and downright toughness!

**No Complicated Specifications!** Ordering is easy, because all you need to specify is the length, diameter and the name —*Tuffy* Hoist Line. Get full measure of hoisting service you pay for with Tuffy Hoist Line!

## TEAR OFF AND MAIL COUPON *NOW!*

Union Wire Rope Corporation
2278 Manchester Ave., Kansas City 26, Mo.

At no cost or obligation to me, please rush the material I have checked:

- ☐ FREE 3-Ft. Tuffy Sling!
- ☐ FREE Sling Handbook and Rigger's Manual, Featuring 12 Tuffy Factory-Fitted Types!
- ☐ Name and Address of Tuffy Distributor Nearest Me!

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*Make your report . . .*

# A New Way to Write a Technical Article

**Here are a few simple rules that might turn that technical report into a marketable article.**

**By CY FREEMAN,**
The Worthington Corporation,
Harrison, N. J.

AT ONE TIME or another, most of you probably wanted or had to write a technical article for a trade publication. Some people can sit down and write an acceptable piece "off the cuff." Most feel rather inadequate. Perhaps you think that your language, way of thinking, or means of expression are so specialized that you can't write for a mass audience.

If you fit this description, here is a helping hand. In these pages, you can learn how to turn a standard technical report into an article that will probably be acceptable to a trade publication editor.

Believing that articles accepted for trade publication are submitted in a finished, polished form is a common fallacy. No editor expects or actually wants this performance. His publication is styled and directed for a picked reader audience. These readers are interested in a certain limited field and have a range of understanding which is interpreted by the editor. That's his job. The author is not expected to interpret his reader audience for him.

Following this line of thinking, it is obvious that a logically written presentation on any particular subject suitable to his readers is what an editor needs. It is perfectly legitimate to assume that the editor has technical background for transposition of what you say to his reader's language and level of understanding.

Our final product, therefore, must only be a logical presentation of what you have to say. The English does not have to be perfect. The piece does not have to read as smoothly as those in the multitude of journals that pass across your desk. To make it that way is the editor's job.

**The First step** in writing an acceptable technical article is to pick a subject. Sounds simple? Sure it is.

The good criterion of whether a subject is appropriate or not is, *Is it*

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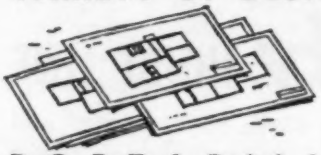

Choose from a large selection of homes, garages, warehouses and other buildings. Get what you want in STURDYBILT.

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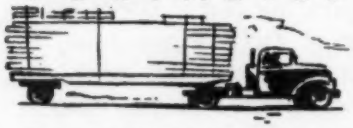

Complete housing sections moved anywhere a truck can go. Buildings erected on your site in days instead of weeks.

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Move your STURDYBILT houses when you abandon an old site. They can be erected on new location with practically no loss of material.

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One purchase order takes care of designing, transporting and erecting. Truly one stop buying when you get STURDYBILT Prefabricated Houses.

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STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

*helpful to the reader?* This reader of which we speak could be any in any of hundreds of fields. We won't even attempt to define him. Just be sure that you write about something you know thoroughly. Your article will "find" its reader audience without help.

There are countless suitable subjects for articles. Keep up with your technical reading. It will point the way for acceptable article subjects. Here are some ideas:

**1.** Installation, maintenance, and operation of equipment.

**2.** Applications of particular interest because of specific prolbems involved, and for which your company has supplied equipment and "know how."

**3.** Job stories or experience record of an installation which would be of interest because of a possible reader's need for a similar idea or experience record.

**4.** Savings or a better product record achieved through use of your company's products or new process methods.

**5.** Engineering subjects—keep in mind the interest and problems of a prospective reader.

**6.** How it works—many seemingly quite elementary but valuable articles on how equipment works are frequently published and have high reader interest ratings.

**7.** Design and test considerations—provided they have a bearing on how a product or operation can be made better or more efficient for the user.

**8.** Articles on technical management, personnel, statistics, etc., are all appropriate.

**The article.** Write a technical report on your subject. (I haven't met an engineer yet who couldn't write a report.) This includes the objective, discussion, procedures and methods, and a conclusion. Illustrate the report with every appropriate picture, curve, and sketch available.

Now to convert the report into an article. Let's do this step by step.

**1.** Copy the objective from your re-


# GASOLINE or DIESEL?

**Hercules engineers will assist you in the proper selection of the most economical type of engine for your particular equipment.**

Many of our customers have asked us, "Which type of engine would be best for me?" Perhaps this same question has entered your mind at one time or another.

Of course, there are many governing factors which should be considered in selecting the proper type of engine for a particular piece of equipment. First of all, how much horsepower is needed? Is there a type of fuel which costs less locally . . . gas, gasoline, L.P. Gas, kerosene or fuel oil? How much money will be involved in the initial purchase? How much money can you expect to save by using a low-cost fuel? Will it be enough to offset the extra cost of a special type of engine? These and many other questions should be objectively answered before any engine is purchased.

We have no particular cause to champion and do not attempt to take sides or promote the use of one fuel over the other. As you know, we manufacture all types of internal combustion engines to operate on any fuel that is readily available. (Natural gas, L.P. Gas, kerosene, diesel fuel, gasoline, etc.)

The basic Hercules gasoline engines are adapted by minor changes to operate on different spark-ignition fuels. The Hercules diesel engines are compression ignited — specifically designed for operation on diesel fuel.

We have, however, maintained several similarities between the Hercules spark-ignited and the Hercules diesel engines which we think are very important. First of all, gasoline and diesel engines of comparable piston displacement have similar mounting dimensions and operating characteristics. Generally speaking, this makes it possible for equipment to be powered by either Hercules gasoline or diesel engines without creating any major installation problems. Thus, equipment manufacturers are able to supply customers with the proper type of engine to assure "top-notch" economies, according to the customers' operating conditions.

Another similarity between our gasoline and diesel engines, is that they both are of the 4-cycle design. The 4-cycle design is universally accepted and understood. This feature provides for less complicated engine servicing and in addition, service is readily available throughout the country.

What does all this mean to you? Maybe we can sum it up in our motto, "Engine Manufacturing Specialists Since 1915". Actually, we're custom engine builders with manufacturing facilities. Our engineering and sales policy is to design and sell engines to meet the exacting needs of our customers.

As a result, we have 70 basic models of gasoline and diesel engines which range from 3 to 500 H.P. They are available in many different designs . . . vertical and horizontal engines, special fuel handling equipment, various types of flywheels, etc. . . . in fact, we probably have an engine that will fit your particular needs to a "T".

Whether it's Agricultural, Oil Field, Automotive, Construction, Industrial, Marine or any other engine application, our engineers will gladly assist you in the proper selection of power for your equipment. Give us the details, so that we understand your problem, and we'll provide the answers to your power problems.

*Engine Specialists since 1915*

**HERCULES MOTORS CORPORATION**

117 ELEVENTH ST. S. E. CANTON, OHIO, U. S. A.




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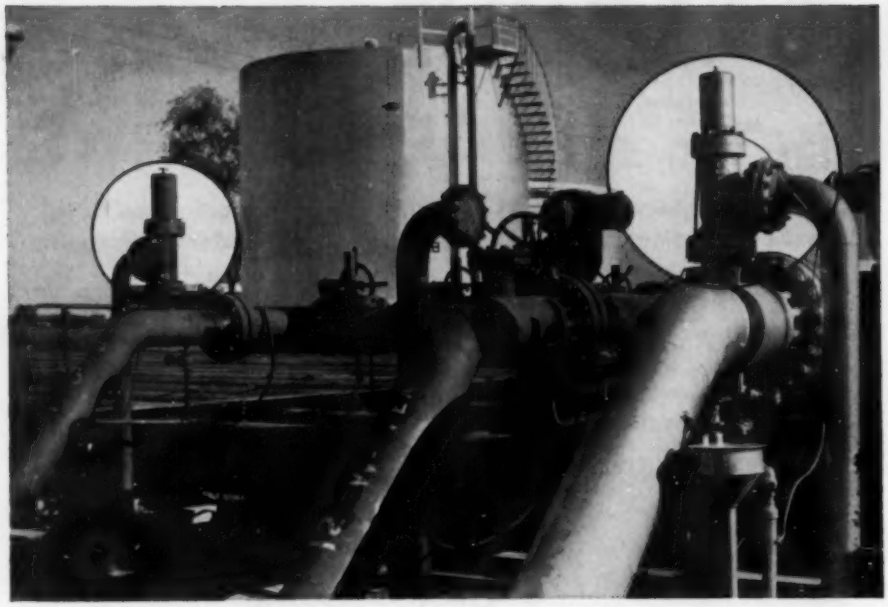
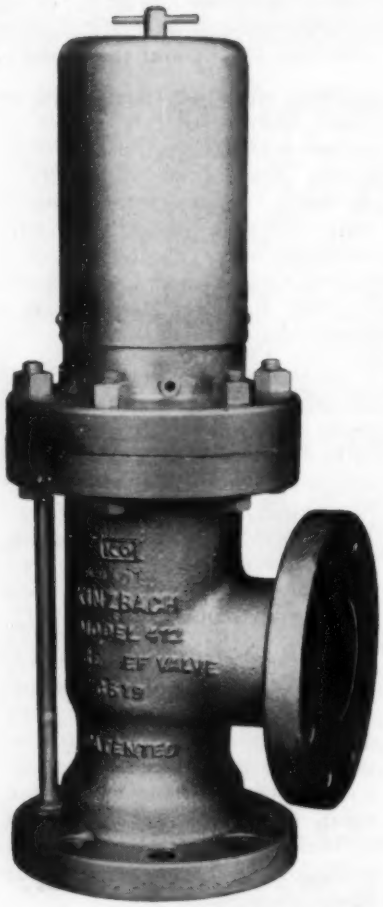


**Positive Protection Against Pressure Surges**



**KINZBACH**
**MODEL 412**
**RELIEF VALVE**
**for Pipelines and Refineries**

When a pressure overload in the line is reached, the Kinzbach Model 412 Relief Valve opens instantly to full capacity. This valve provides automatic resetting at a pre-determined pressure drop, positive seating and facilities for functional testing.

The Model 412 uses line pressure for opening and closing. The opening pressure is preset by application of a dead weight load. Opening and closing action is positive and reliable. The pre-set pressure never changes.

Kinzbach Model 412 Relief Valves are available in 2", 3", 4", 6" and 8" sizes for working pressures up to 1000 p.s.i. Write for Bulletin RV412 for full technical data.

KINZBACH TOOL CO INC

**KINZBACH TOOL COMPANY, INC.**

P. O. Box 277 Houston, Texas

Export Office: 74 Trinity Place, New York, N. Y.

port and follow this immediately with your conclusion. This should make the first few paragraphs of the article. Then add the discussion and the methods and procedures section.

**2.** Take pencil in hand . . . there are changes to be made. Reading through your article, revising as you go, shorten sentences wherever possible. One good way to accomplish this is to imagine yourself playing a word game. The object of this game is to use as few and as short words as possible without changing the original meaning. Attack this scientifically. Forget all ideas about neatly turned phrases. Don't try to write "just like you talk."

**3.** Now examine the article again. It should not necessarily look good at this point. Read through the article again very slowly. Cross out any section that repeats something you have said before, unless you particularly want to emphasize that point or you feel that the repetition is necessary for understanding.

**4.** Now for the basic composition. Revise so as to avoid repetition of similar words in the same sentence. Avoid the use of more than one or two commas in the same sentence. It is a good idea to try to keep most sentences to a limit of 10 to 20 words.

**5.** Re-examine the article for elimination of stodgy phrasing. For example, you might have said in your original report: "Engineers must know the content of dissolved oxygen existing in a boiler feedwater sample because boilers are subject to corrosion resulting from chemical action of the dissolved oxygen." By being very objective and critical, playing the word game mentioned above, we get the following: "Engineers must know how much dissolved oxygen exists in a boiler feedwater sample because this oxygen can cause equipment corrosion." It requires no genius or brilliant style to get this type of simplification. It is all "dog-work" which you can do if you only stick to it.

**6.** Get all of your pictures, graphs, and sketches together; copies will accompany the article. You will sometimes find that the caption describing a key picture will eliminate the necessity for an entire section of copy. If

this is true, write simple captions which will tell how the key illustrations cover a certain point. Eliminate possible duplication in copy from the article and write a substitute sentence referring the reader to the illustration. Give the reader credit for being able to use his eyes and, with a minimum of guidance, interpret an illustration. The old adage—one picture is worth ten thousand words—is a wonderful, profitable tool. Picture stories are well received by all editors.

**7.** The length of an article is not a factor which should overly concern you. As a general rule, don't write more than 6000 words—and if you do, cut it! Within this limit, article length is the editor's problem and he usually has facilities for coping with it. Sometimes this problem is easily resolved by preparing the article in two or more parts.

**8.** There is only one thing left for you to do. Write a short paragraph to be added at the end of your article which repeats, generally and in very few words, the conclusion stated at the beginning.

**Choosing a magazine.** The article is complete . . . for the time being. If an editor needs more refinement, he will tell you about it in detail.

If you want to submit your article for publication personally, go to a technical library and get a listing of all important publications in the field concerned with your article subject. Number these according to your preference. (And don't forget PIPE LINE INDUSTRY.) Write to the editor of publication Number One enclosing a copy of your article and illustrations. Ask for his comments and an early statement as to whether or not the piece is suited for his publication. Don't count on this editor's accepting the article. If he doesn't, write to editor Number Two, and so on down the line. If your subject is chosen along the lines described above, there is a near certainty that one or two will express definite interest in it—always providing that you have not duplicated another person's article content recently published.

Most industrial firms have Press Relations departments which have contacts among trade publication edi-


# Meets A.P.I.* Standards for CUSTODY TRANSFER SERVICE

* American Petroleum Institute

"Varec"

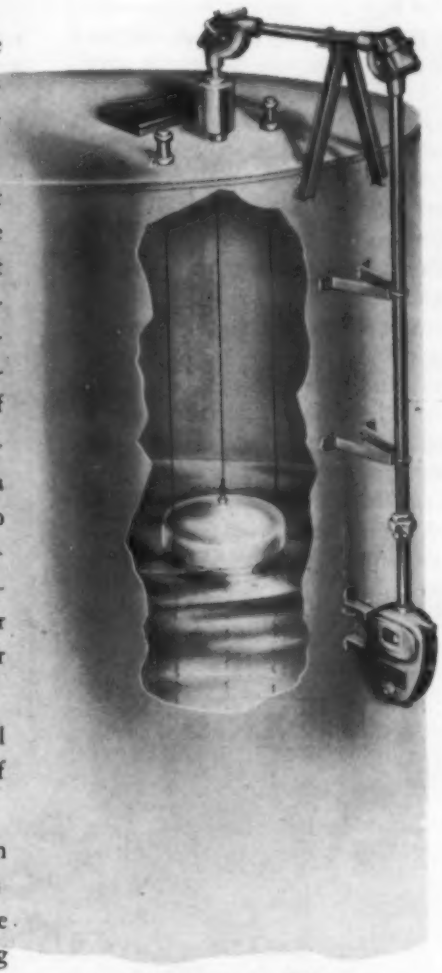
## AUTOMATIC TANK GAUGE

PATENT NO. 1879805, OTHER PATENTS PENDING

Float and Neg'ator motor actuated — ground reading — automatic tank gauge.

It is gastight and will handle working pressures to 15 p.s.i.g. Equipped with gravity compensator and operation checker.

A feature of this gauge is that it is provided with special pipe brackets to insure alignment and a synthetic rubber expansion joint, which allows 2" vertical movement and ½" horizontal movement of tank roof without stress on tape piping.



Where corrosive vapors are a problem, a liquid seal unit to protect working parts is obtainable at extra cost. Standard liquid seal 8½" $H_2O$ pressure or vacuum. Available for higher pressures upon special order.

Recommended for use with all types of low pressure, fixed roof tanks.

Where remote gauging system is anticipated, "VAREC" Trans mitter may be mounted on the cover plate, eliminating cutting into tape piping or gaining access to the float for tape adjustment.

Installation may be made on "tanks in service."

Send for full information—ask for VAREC GAUGING EQUIPMENT Bulletin CP-3007.

"Varec" **VAPOR RECOVERY SYSTEMS COMPANY**
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Cable address: VAREC COMPTON Calif. (U.S.A.) All Codes




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FOR PIPE LINE PUMPS

SEALOL

# Flexibox

MECHANICAL SEALS

SEALOL — exclusive representative in the United States and Canada for Flexibox — offers the pipe line industry a complete and tested line of mechanical seals for pipe line pumps. Flexibox Seals come to this country with over 15 years of actual oil refinery and pipe line service behind them. They afford safety and security never before obtainable with conventional stuffing boxes.

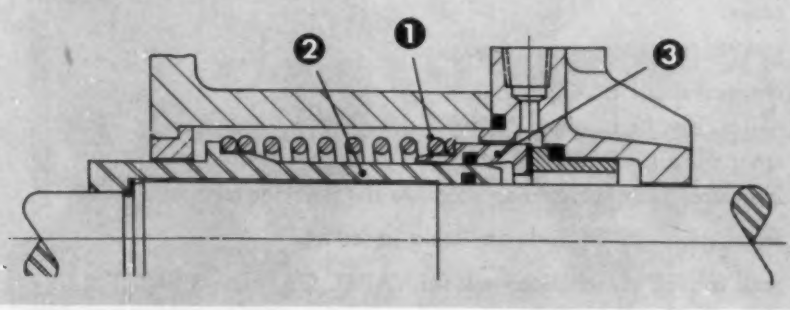
Flexibox Seals are simple and rugged — their unique spring drive reduces mechanical components to a minimum. There are no rubber sleeves or bellows — no keys, pins, slots or grooves. With the Flexibox Type RR seals (shown below) sleeves are furnished as a component of the seal assembly. No pump sleeve required. Designed especially for each installation — no measurements are required for assembly. Seals are supplied with a novel circulating arrangement which assures liquid at the seal faces at all times, removing frictional heat and reducing wear.

Many major oil refining and pipe line companies throughout England, on the Continent, and in South and Central America have standardized on Flexibox mechanical seals for their pumps. Write for Bulletin 9. Sealol Corporation, 23 Willard Avenue, Providence 5, Rhode Island. Chicago • Cleveland • Houston • Los Angeles • Philadelphia • Kansas City • Charleston (W. Va.) • San Francisco • New York • Montreal, Canada. Flexibox, Ltd., Manchester, England.

OPERATING PRINCIPLE OF FLEXIBOX SEALS

The spring ❶ engages the shaft sleeve ❷ at one end and the neck of the rotary seal ring ❸ at the other with interference fits. In operation the coils tend to "wind up", thus further increasing their grip. Consequently, the rotary seal ring ❸ is driven positively yet resiliently.

flexibox




SEALOL

THE BALANCED PRESSURE SEAL

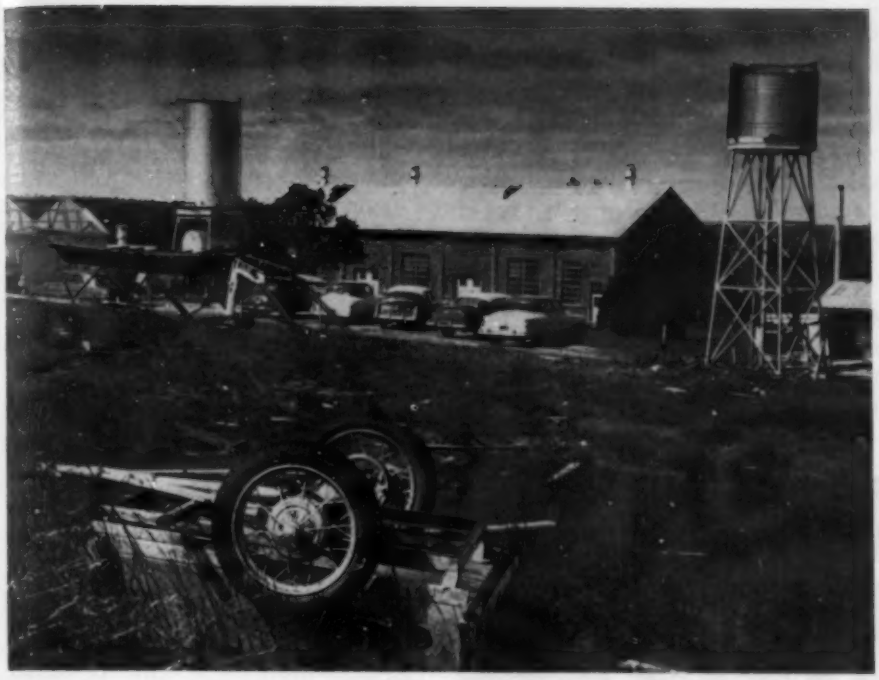

## About the Author

CY FREEMAN, who joined Worthington Corporation in 1953, was formerly with Hearst magazines writing technical articles for the lay public and working on the administration of the Good Housekeeping seal with industry. A mechanical engineering graduate of the Cooper Union in New York, he has also taken post graduate courses in sales and business at the College of the City of New York and New York University. Freeman has been a gas meter reader, a draftsman and an electro-mechanical engineer. As an engineering writer he has worked from editor to technical advertising specialist. At present he is editing Worthington Corporation's magazines and is account supervisor for corporation advertising, The Worthington selective industry product mail system, and other similar projects.

tors. Usually, part of their job is to help place articles written by company authors. This may be the most convenient, and quite often, most efficient method for article placement. This same department can also advise you as regarding whether or not the article can also serve to help better your firm's business. The work will be appreciated by your employer and can lead to his tangible recognition of your efforts. —The End

**HOW DO YOU LIKE IT?**

- **This is YOUR magazine . . . Written and edited to help you with your job . . . Your suggestions are invited!**



**DAMAGE TO MAIN STATION BUILDING** at Payson, Okla., was confined to roof and two large windows that were blown into the engine room. Other buildings sustained more extensive damage and nine miles of telephone lines were blown down.

**A SERVICE PIPE LINE EMPLOYE,** his wife, and five children came out of this wrecked company cottage without a scratch. During the tornado that caused $50,000 damage to station and other installations, the family crouched under the bed and baby's crib.

***Here's what happens when a . . .***

# Tornado Hits Pump Station

CRINGING, THE HOLLINGSWORTH family waited for the angry black cloud to strike. Dorothy, the mother, lay under the crib, clutching her five-months-old baby; Jim, the father, lay beside the bed, consoling the other four children underneath the bed.

Suddenly the company cottage shuddered and rocked. Jim heard a cloth-ripping sound and peeked up to see the roof gone. The east wall, two feet from his wife and baby, went next. Pressure hurt his ears. The chimney tumbled, scattering bricks across the floor of the next room. Dorothy held the baby tighter, and the children crowded closer together. The children did not fuss nor cry.

Then suddenly all was quiet, except for the gentle splatter of rain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(U.S. Pat. No. 2,543,741)

THREAD LUBRICANT AND SEAL

for Casing and Tubing, Drill Collar and Tool Joint Threads

- for precision cut threads
- perfect seal, prevents washouts
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- full makeup, easy breakout
- withstands high pressure & temperature
- perfect thread and shoulder contact
- will not pack or work harden
- perfect matrix for damming
- will not separate
- corrosion and rust inhibitor

Contains pure metallic lead and copper flake.

JET-LUBE APPLICATOR

For applying lubricants faster without hand brushing. Prevents lube contamination. Reduces consumption. Insures clean lube. Saves time, equipment.

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Jet-Lube of Canada Ltd., Edmonton, Alberta




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on the bedroom floor. The Hollingsworths scrambled to their feet. Jim rummaged through the roofless closet for coats for everyone.

Other Service Pipe Line Company employes and their families rushed from their company cottages into the gathering darkness. They shouted questions, asking about each other's safety.

The tornado originated near Shawnee, Okla., and ripped a 20-mile path from southwest to northeast, ending its destructive journey a few miles beyond Service's Payson pump station. It hit the station and cottages at 6:29 p.m., May 1.

As soon as the storm had passed, Frank Ludlum, chief station engineer, checked and found everyone safe and uninjured. (They had been forewarned of the storm by frequent TV and radio alerts.) Frank found all telephone and power lines out. He instructed B. A. Prater, station engineer on duty, to continue running the diesels as they were until he could get back from division headquarters at Shawnee with help.

Frank went to Division Manager O. O. McKenzie, who immediately contacted William Hadley, Shawnee district superintendent, and instructed him to call out a work crew and to establish radio communications at Payson station with the Shawnee base station. Pumpings were reduced through Payson.

The Shawnee crew hauled out a light plant from Shawnee and dispatched a man to Drumright to bring a second light plant to aid in work that went on through the night. The crew assisted the people in boarding up broken windows, moving furniture and clothing from the demolished cottages into the station building and heating plant. Employes in the demolished homes stayed with their neighbors.

McKenzie estimated damage to company property at $50,000. Major damage included:

**1.** Nine miles of company telephone lines blown down. All men in the Shawnee and Carlson districts with telephone and telegraph experience were called out to repair the lines. Mobile radio units provided communications until the lines were restored May 3.

**2.** Total loss of three cottages and $15,000 damage to the roofs, porches, siding, windows, etc., of the other five cottages.

**3.** Damage to the main station building was confined to the roof and two large windows on the west side that were blown into the engine room.

**4.** Some glass was broken and the roof blown off the steel and sheet iron-covered shop building.

**5.** A lean-to garage used by employes for storing their cars was blown away. Destruction of the garage caused minor damage to almost all of the employes' automobiles.

Most of the trees on the station grounds were damaged with several 16 to 20-inch-diameter trees being uprooted. An 8 by 10-foot gager's office a half mile west of the station was demolished. Other buildings, water tank, etc., received slight damage.

The tornado once again demonstrated the usefulness of V.H.F. radio by providing vital communications while telephone lines were down. Supervisors and employes demonstrated their skill by restoring communications and repairing other damage in a hurry. —**The End.**

ARCCO
The World Over
wherever there is gas
ARCCO-ANUBIS
'Dry-Air GAS
GRAVITOMETERS
This new Arcco-Anubis Dry Air Gas Gravitometer determines and records specific gravity of gases automatically corrected to the humidity content of the air. The difference in weight between a column of GAS and equal column of DRY AIR is measured. This ratio represents the true specific gravity of the sample.
One bell of the instrument is filled with gas which is being measured, and the other bell is filled with dry air. Otherwise, except for the new instrument having one column for gas and one column for dry air, the unit is identical in operation to the standard gas gravitometer. When calibrated and properly installed, these instruments require little attention other than to wind the clock, ink the pen, and change the chart. Send for bulletin No. 101.
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SHELL PIPE LINE CORPORATION 1954

| CODES | PIPE LINE No. | LEASE No. | DATE MO. | DAY | TICKET NO. | CORR. 60° GVTY. |
|---|---|---|---|---|---|---|
| | | (114911) | (12 | 11) | (245) | |

CHECK BY CALC.

DISTRICT TXL Ellen.
OWNER Shell Oil
LEASE NAME TXL "K" Wells 1-4

| TANK NO. | TANK SIZE | IND. GRAVITY | IND. TEMP. |
|---|---|---|---|
| (396) | 500 | (40.5) | (80) |

| % B.S. & W. | TANK TEMP. | FEET | INCHES | CACULATED BARRELS | |
|---|---|---|---|---|---|
| (1/10) | (78) | | | | |
| | 1ST. MEAS. | (15 | 6) | 508 | 21 |
| | 2ND. MEAS. | (1 | 6) | 50 | 25 |
| | | | | (457) | 96 |

Fig. 1—Top half of typical crude oil run ticket.

# Electronics Can Save Money In Crude Oil Accounting

**Digital computers make 45,000 calculations monthly to eliminate errors, speed up tabulating of run tickets and simplify accounting procedures for Shell Oil Company in West Texas.**

**By J. E. PECK,** Treasury Manager, Midland Area, Shell Oil Company, Midland, Texas

RECENT DEVELOPMENTS in electronic data processing machine design permit automatic handling not only calculating functions but also clerical functions usually performed by a machine operator. And these operations can be performed accurately at maximum electronic speeds with little or no human intervention once the operation is started. Because of the tremendous speed and capacity available in these processing systems, "bigness" in paper work is no longer a problem.

In the oil industry, accounting for crude oil is probably one of the most successful financial applications of electronic equipment. Conversion from desk calculator procedure to an electronic method has the effect of:

- Reducing staff personnel handling run tickers.
- Eliminating calculation errors.
- Speedup in furnishing weekly tabulated net production returns to field offices by leases.
- Practically eliminating production clerk's run ticket duties.

Each ticket is a record of a sales transaction and is the starting point of all of crude oil accounting. Upon

**TEMPORARY STRAINERS**

MAC-IRON

*Established 1901*

Made by a skilled mechanic and not by "just some guy with a torch."

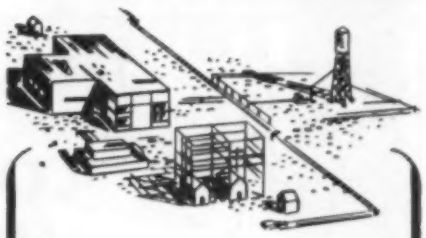
**REVOLUTIONARY CONSTRUCTION**

Smooth, efficient contours . . . no weld "blob" around edge of ring. The flange is precision rabbeted into the ring joint gasket making deformation at that point impossible.

MAC-IRON offers a complete listing of line and temporary strainers. The latter of woven wire, perforated basket and conical . . . all for use with raised face, and ring joint flanges.

A large stock on hand is maintained; special strainers made to specification. Write direct for a catalog and complete information.

**The Mack Iron Works Company**
Warren and Water Sts. Sandusky, O.



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*What type thermometer is most easily adapted to* **YOUR** *installation?*

Because the stem can be located anywhere around the dial, straight-form thermometers are easily adapted to practically any installation. Here's a Rochester Thermometer that gives you the adaptability of a straight-form PLUS two big Rochester Thermometer exclusives.

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It takes a hard blow to knock a Rochester Thermometer out of adjustment, but, if it should happen, you can recalibrate the Straight-Form yourself with a simple **external** adjustment—a Rochester exclusive.

**Rochester** Manufacturing Company, Inc.
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DIAL THERMOMETERS GAUGES AMMETERS

*He's doing it Quickly and Correctly with a*

**LOWELL # 50-A**
**Reversible Ratchet Wrench**

Here's why many major pipe line companies are asking for the new Lowell #50-A Wrench.

**1—The reversible ratchet speeds installation of mechanical pipe line couplings.**

**2—Its special 8″ handle assures correct torque on 5/8″ bolts.**

Other reversible ratchet wrenches available with handles up to 36″ lengths.

Be sure of the right wrench for pipe line jobs . . . ask your industrial distributor for the #50-A or other Lowell Series 50 Wrenches.

**LOWELL WRENCH CO.**
WORCESTER 8, MASSACHUSETTS


receiving run tickets daily from the field, the tabulating section key punches into cards the information which is circled on the sample. The lease number identifies the district, owner, and lease name, the date is the day the run is commenced, and the ticket number is a consecutive numbering of runs starting with number one for every lease at the first of each year. The tank number indicates the tank from which the run was made. Indicated gravity, indicated temperature, percent BS&W, and tank temperature are necessary for converting gross barrels to net barrels. Calculated barrels are inserted by the gager and only the whole gross barrels are inserted in the tabulating cards.

The electronic calculation of these run tickets is effected by setting up the tank tables into a master deck of cards and setting up one of the correction tables in another deck of master cards and the other correction tables into the control panel of the calculator itself.

Specifically all the information in 6000 tank tables are placed in a permanent deck of master cards termed the increment master deck. In these cards are set up the barrels of oil per one-fourth inch for each different section or increment of every tank. Due to structural differences, braces, plates, etc., there are capacity variations for different sections of most tanks. The increment deck takes cognizance of this variation by having cut into a card for each section the top and bottom feet, inches and quarter inches. the quarter inches in the area covered, the number of barrels per quarter inch, and the barrels in the total lower preceding increments in that tank.

Once each week and at the month end, the run ticket cards are sorted by lease and tank number and measurement sequence. Utilizing a collator to seek out the proper increment master card to go with each run ticket, the combined deck of increment and run ticket cards are fed into the electronic calculator. In two runs through this machine, at the speed of 100 cards per minute, the gross barrels run (the 457.96 amount shown in Figure 1) is calculated and punched into the run ticket cards. The calculator automatically verifies the whole number in its answer (457) against the 457 that was originally punched in

the card, and the machine stops if there is a difference.

The second set of master cards is actually the ASTM-IP API gravity reduction Table 5 placed into punched cards. By combining these cards with the run ticket cards showing gross barrels, the electronic calculator adjusts the indicated gravity on each run ticket to 60°. The other correction table, ASTM No. 7, which is used to correct the temperature, has been wired into a control panel for the calculator and combined with the BS&W correction to let electronics do the searching and computing necessary to adjust gross barrels to a corrected net barrel figure. Passing net barrels through the calculator with a master pricing deck of cards yields gross value of the crude run.

At month's end, all run ticket cards for the month are summarized into cards showing net barrels run from each lease and the gross value of the crude. These cards are in turn combined with tax rate master cards and again calculated and punched to obtain the applicable production tax and the net value of monthly lease production.

With all information available in the cards for completing the accounting operation for the month, journal entries are prepared from the total cards by using the calculator and more master cards to split the volumes and values of each lease's production. Amounts of sales, receivables, purchases, payables, tax expense, tax liability and the company's interest production applicable to each lease is obtained. By using a special accounting machine, all of these figures for all leases are accumulated and the entire month's crude oil business is condensed into a handful of journal entries.

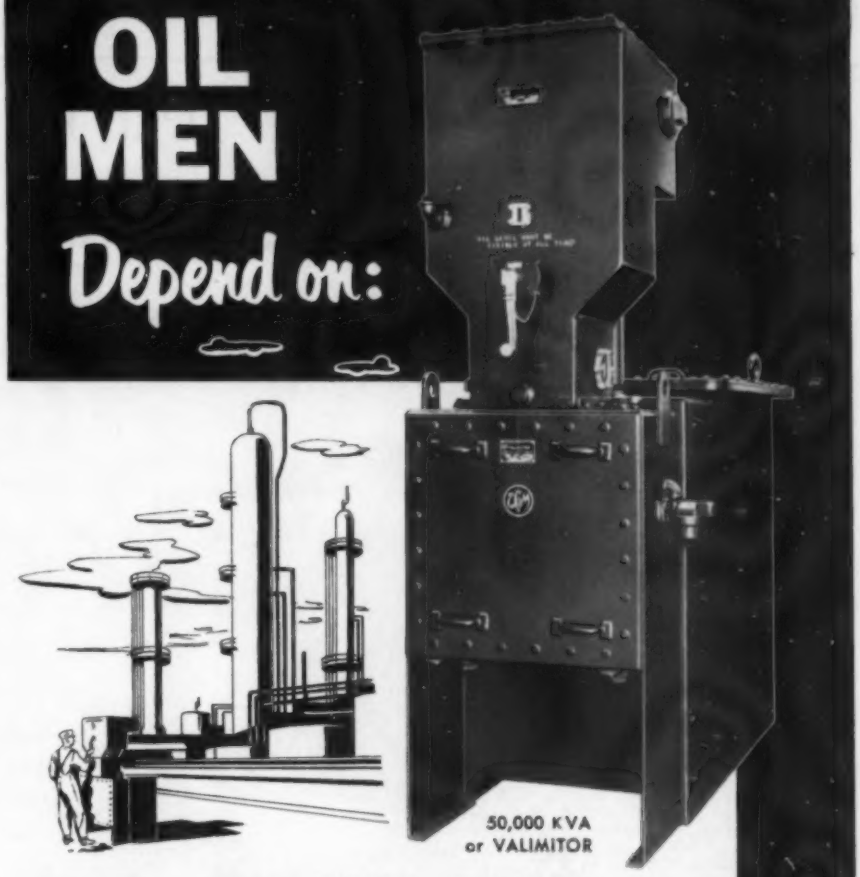
Duplicate decks of lease summary cards are used simultaneously to prepare pipeline statements to other operators, reports to state taxing and regulatory bodies, and payments to interest owners. Payment procedure is entirely dependent on the calculator which performs 45,000 calculations monthly in order to split production among the various owners.

ACKNOWLEDGMENT

This article is based on a paper entitled: "Electronics—New Servant of Accounting" presented at Conference of Accountants, University of Tulsa, Tulsa, April 29, 1954.

—The End

OIL MEN Depend on:




EC&M 2200-5000 VOLT Motor Starters

These EC&M Division 1 combination Starters for Class I, Group D hazardous locations give petroleum men top-value. They require less floor space . . . line, motor and control leads are brought to conduit connection box for quick installation . . . and interrupting capacity is high . . . either 50,000KVA or in the VALIMITOR (volt-ampere-limitor) type, unlimited short circuit protection.

Oil disconnect switch (on top) may be locked open or closed, and has view windows on both sides to show switch contacts. Overload Relays of THERMAL-MAGNETIC type (mounted in conduit connection box) give accurate motor protection . . . trip instantly on faults.

Rear oil-tank has potential transformer for 220-volt push button circuit. 50,000 KVA type ZHS Magnetic Contactor may be inspected without disconnecting any bolts or leads. Contacts are copper tungsten alloy. VALIMITOR Starters, with air-core current-limiting reactors in rear tank, limit fault current to 25,000 KVA . . . ZHS Contactor clears circuit quickly. No fuses, no need to figure short possibilities . . . supply bus can be infinite KVA.

Before buying, investigate EC&M Combination Starters . . . they provide economy in installation, operation and maintenance . . . and they're complete in every respect.

1915

*Write for 16-page Booklet 1062 on EC&M 2200-5000 volt starters.*

THE ELECTRIC CONTROLLER & MFG. CO.

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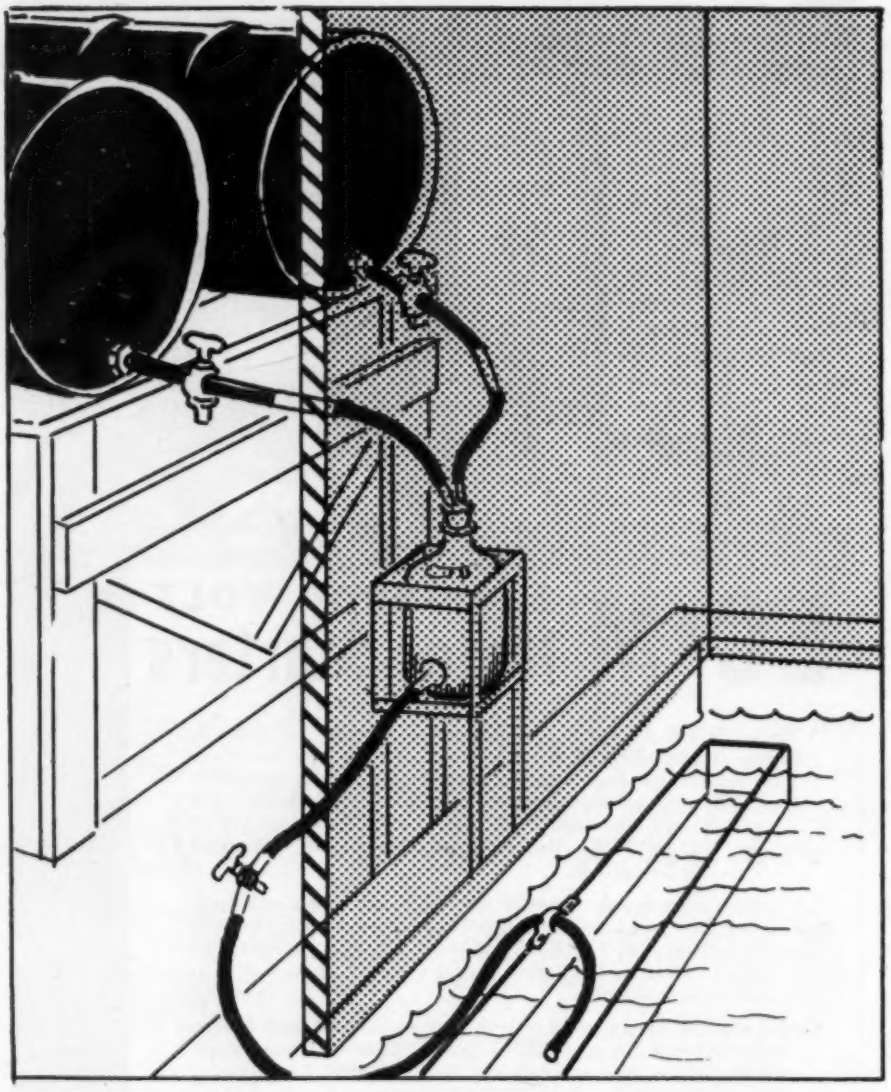
# How to do it

# PIPE LINE HINTS

**$10 is paid for each illustrated acceptable contribution. Mail to The Editor, PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1, Texas**



## Minimize Danger in Handling Acid

To combat the effects of too high an alkalinity the water in cooling towers is treated with concentrated sulfuric acid. But handling of the acid is dangerous, and the above system was designed to minimize the operator's contact with the acid.

The acid is stored in the two drums. A metal adapter is fitted into the bung hole of the barrel and a plastic line extends from the adapter to a glass valve and then to a glass gallon jug. This jug is calibrated so the operator can determine how much sulfuric he is adding during any given time interval. From the bottom of the jug a valved plastic line runs to a wooden trough about six inches across and ten inches deep. This trough is slightly submerged in water and has holes cut in the sides for the water to enter and mix with the sulfuric acid. This prevents the heavy sulfuric acid from settling and concentrating at the bottom of the basin.

## Use Adding Machine To Tally Pipe

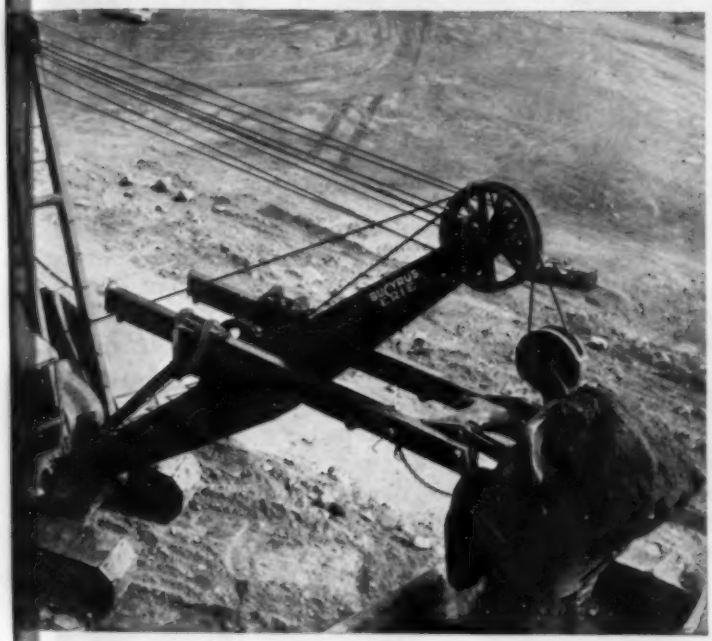
Use an adding machine to tally pipe. Put feet and inches in the machine just as dollars and cents. When the column is complete, hit the subtotal bar, then insert the number corresponding to the total inches according to the following table. (Determine by inspection hundreds of inches over 99.) The total will be the correct feet and inches.

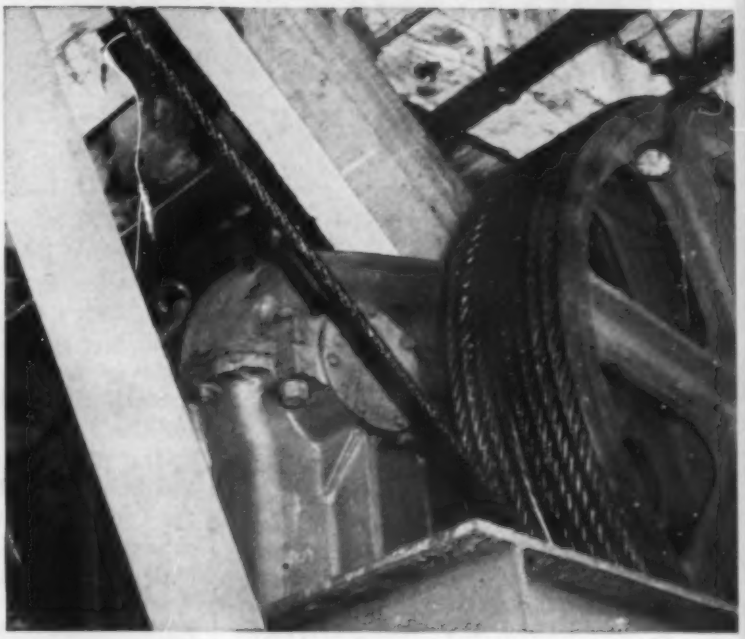
**TABLE:**

| Inches: | | | | |
|---|---|---|---|---|
| 1 | to 11 | Incl. | Add | 0 |
| 12 | to 23 | Incl. | Add | 88 |
| 24 | to 35 | Incl. | Add | 176 |
| 36 | to 47 | Incl. | Add | 264 |
| 48 | to 59 | Incl. | Add | 352 |
| 60 | to 71 | Incl. | Add | 440 |
| 72 | to 83 | Incl. | Add | 528 |
| 84 | to 95 | Incl. | Add | 616 |
| 96 | to 107 | Incl. | Add | 704 |
| 108 | to 119 | Incl. | Add | 792 |
| 120 | to 131 | Incl. | Add | 880 |
| 132 | to 143 | Incl. | Add | 968* |
| 144 | to 155 | Incl. | Add | 1056 |

**EXAMPLE**

| | |
|---|---|
| 40.02 | |
| 40.03 | |
| 40.04 | |
| 40.08 | |
| 40.09 | |
| 40.10 | |
| 40.03 | |
| 40.10 | |
| 40.11 | |
| 40.05 | |
| 40.08 | |
| 45.09 | |
| 45.09 | |
| 44.05 | |
| 44.05 | |
| 44.03 | |
| 39.03 | |
| 30.10 | |
| 40.10 | |
| 40.08 | |
| 812.35 | Sub Total—(135 Inches) |
| * 9.68 | Taken from Table |
| 822.03 = 822 Feet, 3 Inches | |

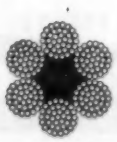




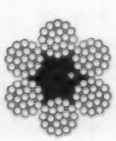
EXTRA FLEXIBILITY—Wire rope encounters fast sheave action, reverse bending, constant stop-and-start operation on many jobs. When this same rope must also lift or pull heavy loads, an unusually flexible, strong wire rope is needed.

Rope jobs like paver skip hoists, overhead cranes, large shovel and dragline hoists, and sawmill carriages demand these qualities. That's where the use of 6 x 37 Red-Strand wire rope saves time and money.

# Where will 6x37 Red-Strand improve your wire rope service?



6 x 37



6 x 19

Look at a cross section of 6 x 37 wire rope. You see three rings of small, uniformly sized wires in each strand. This differs from a rope construction like 6 x 19, which contains fewer and larger wires.

The *smaller size* wires make 6 x 37 more *flexible*. The *larger number* of wires maintains rope *strength*.

Would this combination improve your wire rope service? Would it solve a problem for you? Leschen's higher-than-rated quality is also providing longer-than-expected service to heavy industry everywhere.

Check with your Leschen man. He can help you.

Leschen's 64-page Wire Rope Handbook tells you all about 6 x 37 and other Red-Strand wire rope constructions. Ask or send for your free copy.

**LESCHEN WIRE ROPE DIVISION**
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LESCHEN
HERCULES Red-Strand
WIRE ROPE

CLEANING, COATING, WRAPPING & RECONDITIONING

★

# HOT DOPE

## Straight from the Kettle on *PIPE PROTECTION*

★

***By Boyd Mayes***

**Back when pipelining was just growing up and cross-country pipe lines were a dream, most all industrial gadgets enjoyed today were experimental. A lot of facts about petroleum transportation were floating around, but nobody much figured oil and gas would be moving across the country in lines up to 36" in diameter. A couple of smart operators made it . . . for the government, and based on a war. Best thing we know happened after that was the gas pipe line transport business. Then pipelining came into its own by lighting up the Eastern Coast. All of which proves pipeliners are aggressive, go-after-it folks. Nothing stops 'em, and we doubt that anything ever will. We hear now that one outfit is planning to use its lines again for finished oil products instead of gas. (Originally was crude.) Wouldn't surprise us much if they some day use such lines to transport other liquids than water for folks to drink. Sure would save a lot of carting around by train, truck and boat. To make such a thing not only possible, but feasible and profitable, engineers and manufacturers are fighting corrosion harder than ever. Our job of cleaning, coating and wrapping pipe is a major weapon against this pest of nature. We've got the skilled men and the modern equipment to do this important job and we're busy every day on transmission pipe lines from ½ inch to 72 inches in diameter.**

**MAYES BROS.**

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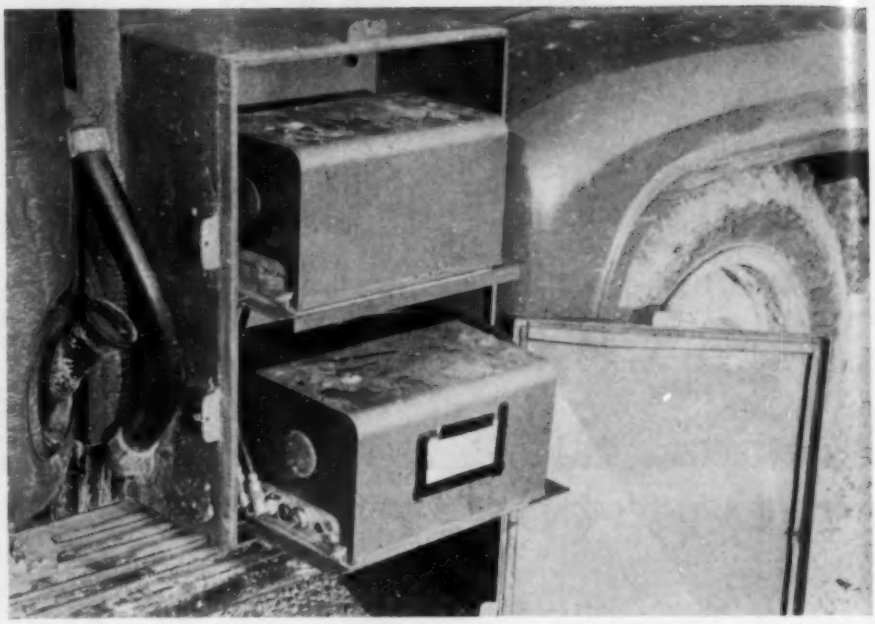

## Radio Cabinet Has Sliding Shelves

A moisture-proof type 14-gage sheet metal box with sliding shelves, and bolted to the side of the cab, is one solution to the difficult problem of finding space to install two-way radio in a modern truck. One shelf is for the transmitter and the other, for the receiver.

The remote controls, mounted on the dashboard with mike and speaker, are completely out of the way. The cables for the remote system run under the floor mat, out through a hole drilled in the rear side of the cab and through a rubber flexible conduit with regulation conduit connectors on each end. The connectors can be screwed into both the cab of the truck and into the side of the radio cabinet.

The cabinet is mounted on the side of the truck with one-half inch stove bolts through the side boards. A snap-tight cover with rubber gasket material glued to the inside seals the front opening. It is fastened in place

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Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. Push-Button Faucet at slight additional cost.
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*Crews find that the uniformity of Republic Electric Resistance Weld Pipe makes for rapid welding.*

*Welders tacking together two lengths of 26" diameter Republic Electric Fusion Weld Line Pipe used in 65 mile line between Cleveland and Petersburg, Ohio. Finish welding will be done on a Fusion Weld field unit.*

# With Republic Line Pipe you can weld field joints *fast*

● *High-speed welding of the entire circumference, with no delays.* That's what you get when you use Republic Line Pipe. Field joints line up quickly and accurately. There's no shifting out-of-round pipe to find true-fitting ends.

The highly ductile, low carbon steel welds readily, too. High ductility assures smooth bends in the field or shop without severe wrinkling.

What makes Republic Line Pipe so easy to weld? Uniformity. Uniform flat rolled steel is formed into pipe of uniform circumference. Walls are uniform. Uniform yield strength means dependability in every inch of line.

Republic Electric Fusion Weld Line Pipe comes in sizes 24" through 30" O.D. Republic Electric Resistance Weld Line Pipe runs from 2⅜" through 16" O.D.; Republic Continuous Butt Weld Pipe from ⅛" through 4" nominal.

Remember: when you need line pipe for oil and gas transmission, high or low pressure, call Republic. You can get more information from your nearest sales office. Or write to:

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Export Department: Chrysler Building, New York 17, New York

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**REPUBLIC LINE PIPE**

ELECTRIC RESISTANCE WELD • ELECTRIC FUSION WELD
CONTINUOUS BUTT WELD

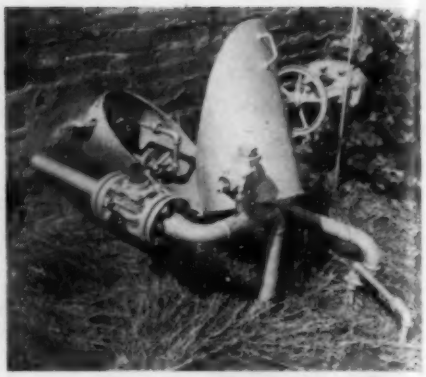
by three bolts that pass through threaded tabs welded on top and sides of the cabinet.

This provides a ready access to the set and leaves cab and bed room for driver and work equipment. With the sliding shelf installation, the serviceman can pull out either receiver or transmitter and service it without having to wrestle with moving seats or to scramble under shovels and picks to find the radio when it is mounted in the bed of the truck.

## Indirect Heater Prevents Regulator from Freezing

A shop-made heater from a joint of 12-inch pipe keeps the regulators warm for Kansas Nebraska Natural Gas Company in the coldest weather. By making the regulator and meter stations out of brick with the door in the roof, just a slight amount of heat is necessary on the coldest days.

The heater consists essentially of a joint of 12-inch pipe with a flue



running through it and a coil of two-inch pipe beside the flue. The coil of pipe is on the upstream side of the regulator and the four-inch flue runs from the end which is outside of the building to a point above the roof.

As shown, the flue is equipped with a jet type burner from gas from the downstream side of the regulator. A thermostat is placed in the water bath just above the burner so that a minimum of gas is used. It is only necessary to keep the water in the 12-inch pipe around 60 degrees in order to prevent the regulator from freezing up.

## Ice Cream Cartons Form Seal for Anodes

An ordinary quart size ice cream carton makes an excellent form for pouring the hot tar, asphalt or pitch seal that goes at the top of graphite anodes to protect the electric cable connection. As shown in the illustration, the five-foot-long anodes are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placed upright in a shallow hole, then the seal is heated over the portable burner shown in the foreground. The lid of the carton is discarded and the cable is threaded through a small hole in the bottom. The carton is then snugged over the anode, and a hole is cut in the inverted bottom, so the seal material can be poured.

## Umbrella Stand Is Easy to Install

The welder's swamper will welcome this umbrella stand. He can sink it in the ground with his foot and forget about holding the umbrella. The holder is made by welding a section of steel rod, pointed on one end to a length of scrap pipe. The handle for pushing the pipe into the ground is made of scrap channel iron.

**HOW DO YOU LIKE IT?**

- **This is YOUR magazine . . . Written and edited to help you with your job . . . Your suggestions are invited!**


**SPECIALIZING IN 4" and 6" PIPE***

Newport Steel

**SIZES AND WEIGHTS AVAILABLE**

| O.D. | Wall | Wt. Per Ft. |
|---|---|---|
| 4½ | .125" | 5.84 |
| | .142" | 6.61 |
| | .156" | 7.25 |
| | .188" | 8.64 |
| | .219" | 10.00 |
| | .237" | 10.79 |
| 6⅝ | .134" | 9.29 |
| | .156" | 10.78 |
| | .188" | 12.89 |
| | .219" | 14.97 |
| | .250" | 17.02 |
| | .280" | 18.97 |

Here you can be sure of getting both the quality and quantity of 4" and 6" line pipe you need, because Newport Steel devotes its entire pipe making facilities to producing the sizes shown on the left. This pipe is economical, too, because the higher quality of our electric furnace steel permits thin-wall construction and less tonnage, while maintaining more than adequate resistance to the high pressures in today's lines. Electric resistance weld process and subsequent exacting tests conform to all API and ASTM requirements, and constantly prove themselves in the field. Call Newport the next time you need 4" and 6" sizes, or any of the other products listed below.

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Newport Steel is situated on the Mississippi-Ohio River system and the great Cincinnati rail hub. With the advantage of location, new river barge facilities and seven major railroads, Newport gives economical, dependable delivery to industrial areas throughout the Middle West and South.

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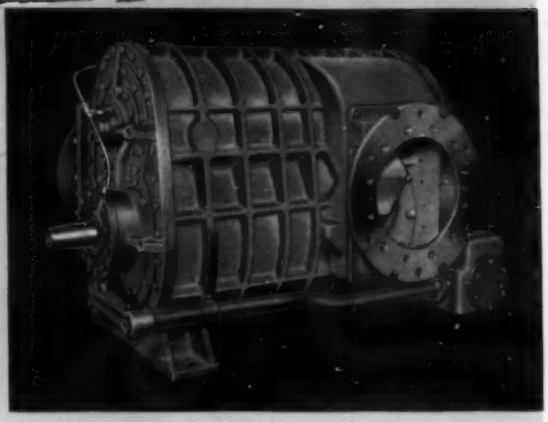

*safely handle large volumes of gases...*

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*Standardaire Blowers* move more gas or air, with less wear, and with lower maintenance and power costs than other blowers of equal weight or size.

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Read Standard also manufactures a complete line of blenders for laboratory and industrial use. For information write Read Standard Corp., York, Pa.

## Conditional Approval Won On Louisiana-Michigan Line

American Louisiana Pipe Line Company, Detroit, has been granted conditional FPC authorization to construct a 1172-mile Louisiana-to-Michigan natural gas transmission system to serve ultimate markets in the Michigan-Wisconsin area. The line will run from North Tepetate, La., to a terminus at Detroit, Mich.

At the same time, Texas Gas Transmission Corporation was authorized to build additional facilities to supply approximately 18 billion cubic feet of natural gas annually to American Louisiana. They will construct 48 miles of 26-inch line in Tennessee and Kentucky and install additional pumping power at Covington, Tenn. This construction will complete the looping of the Texas Gas 26-inch line from Bastrop, La., to Slaughters, Ky.

Certificates for both companies were conditioned upon certificates being issued by the Commission to gas producers.

## Construction Starts On California Crude Line

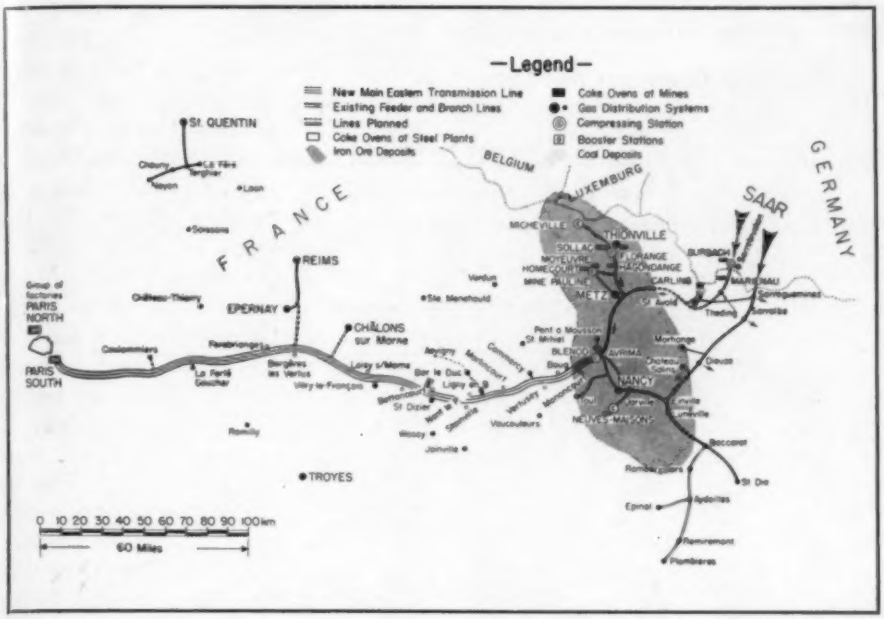
Union Oil Company has started construction on a 12-inch, 65-mile crude oil line between its Torrey Canyon lease near Santa Paula and the Los Angeles refinery.

The line will be laid in a generally southerly direction through the Torrance tank farm and into the refinery. With an initial capacity of 50,000 barrels daily, it will cost approximately $4 million. Completion is scheduled for early April, 1955.

## H. C. Price Gets Contract For 68-Mile TGT Line

H. C. Price Company, pipe line constructors of Bartlesville, Okla., has been awarded a contract with Tennessee Gas Transmission Company for the construction of 68 miles of 26-inch natural gas pipe line loops.

Work will be divided in four loops extending along the existing 26-inch main transmission line in Ohio. Construction crews began laying pipe in October.




## First French Line Partially Completed

The French gas industry, Gaz de France, has just completed the major portion of its first long-distance gas transmission line.

Surplus coke oven gas is being piped from the coal and steel producing regions of northeastern France to Paris and points along the way. The coke ovens are located in Lorraine and the Saar Territory, where iron ore and coal are found in abundance. Gas from the coke ovens is compressed to about 850 pounds per square inch for transmission.

The main feeder lines converge at Blenod and a 200-mile main line connects Blenod with Paris. The entire system, when completed, will be approximately 380 miles long.

American gas cleaning equipment is installed at a number of compression and reducing stations on the line.

### Sunray Oil Purchases 55-Mile Texas Line

Sunray Oil Corporation of Tulsa has purchased the 55-mile crude gathering system of the Ed Scurlock Pipe Line Company and all its facilities serving the Victoria, Texas, area. The line will become a part of the 100-mile Gulf Coast system of the Sunray Coastal Pipe Line Company.

Suntide Refining Company of Corpus Christi has contracted for the purchase of Sunray's Corpus Christi crude oil terminal and marine loading docks and has effected a management contract with Sunray Oil to manage the Sunray Coastal gathering system, including the Scurlock lines.

### Continental Opens New West Coast Terminal

Continental Oil Company has opened its new million dollar pipe line terminal in Spokane Valley. The terminal receives petroleum products from the 540-mile Yellowstone pipe line which transports products over the Rockies from Billings, Mont., to Spokane.

### Construction Starts On 48-Mile Offshore Line

Brown and Root of Houston is building a 48-mile offshore pipe line for Continental Oil Company, Newmont Oil Company and Magnolia Petroleum Company. The line, which runs off St. Mary's Parish, La., into the Gulf of Mexico, will have a capacity of 50,000 barrels of crude oil per day. Construction is under way.

### Buckeye Awards Contract For Ohio Products Line

Contract for the Buckeye Pipe Line Company's eight-inch products line from Lima, Ohio, to Columbus has been awarded to Sheehan Pipe Line Construction Company of Tulsa. Construction has begun and the line is expected to be completed by the end of the year.

The line is an extension of Buckeye's Midwest Products System which runs from Lawrenceville and Robinson, Ill., to Toledo, with intermediate terminals at Indianapolis, Muncie and Lima. Buckeye will also convert an existing eight-inch crude line to products service between Toledo and Lima.

### Great Lakes Completes 717-Mile Building Program

Great Lakes Pipe Line Company of Kansas City, Mo., has completed construction of 717 miles of new lines scheduled in its current expansion program.

First addition was 353 miles of 12-inch lines from Kansas City to Des Moines and an extension from Rosemount, Minn., a few miles south of St. Paul, to Alexandria, Minn.

A total of 364 miles of eight-inch lines was laid to extend the system from Nebraska City to a new terminal at Doniphan, Neb., to run a parallel line from Alexandria to Fargo, N. D.; and to build an extension of the eight-inch line from Iowa City, Iowa, to a junction with the Badger line near Rochelle, Ill.

### Sinclair Moves Office To Service Western Kansas

District office of Sinclair Pipe Line Company now at Independence, Kansas, will be moved to Great Bend.

A continuing increase in the number of successful drilling operations and the exploration and production of new fields in Western Kansas have brought an increased demand for pipe line transportation. The relocation of the office is expected to expedite the operations of its field forces in the movement of this oil to Sinclair's trunk line system.

## Ohio Oil Company Builds 35-Acre Illinois Center

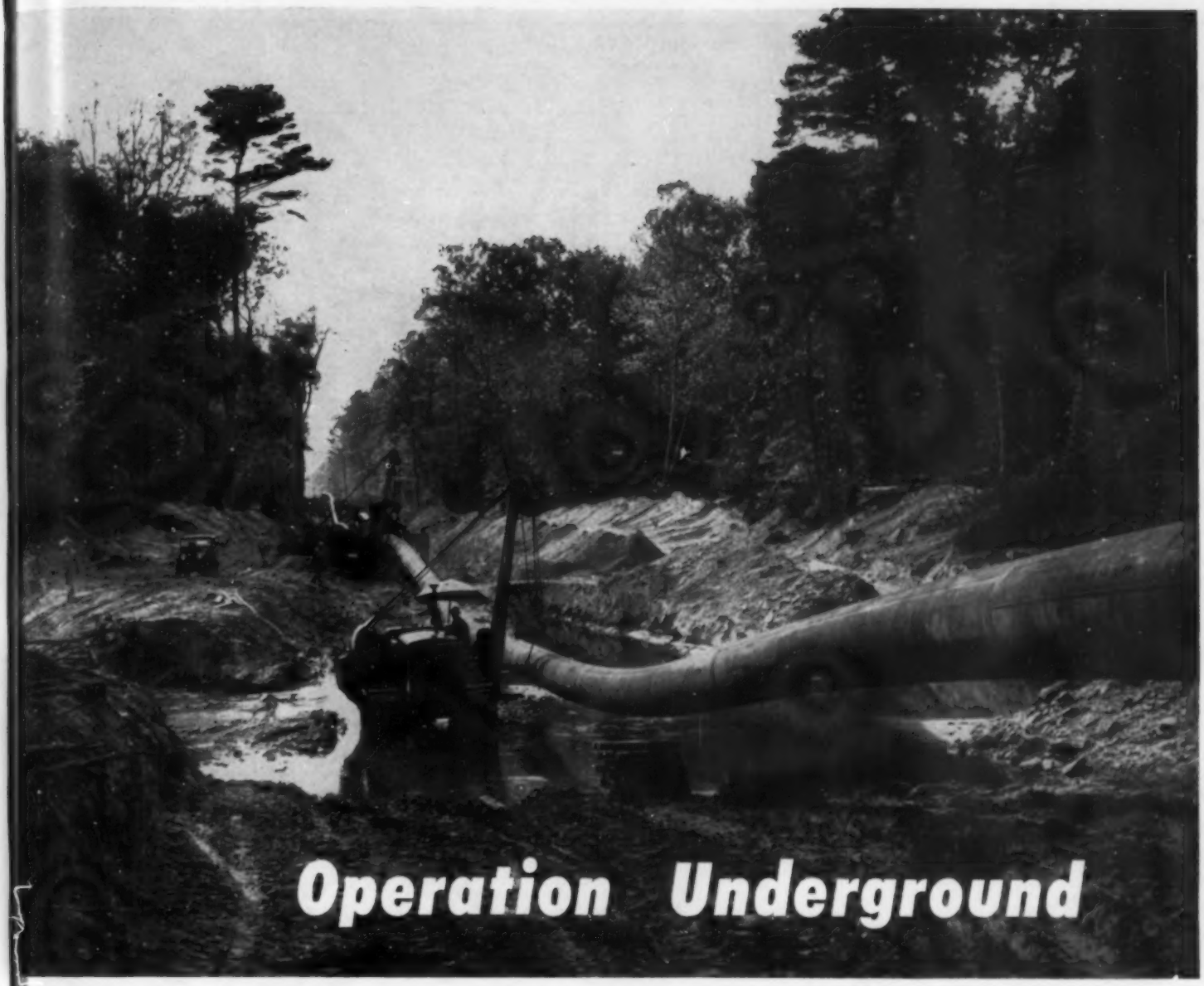
Construction of The Ohio Oil Company's production and pipe line office and operating center at Bridgeport, Ill., was started recently on a 35-acre tract on the north edge of the city. Anticipated completion date is August, 1955.

The center will replace and consolidate inadequate and scattered facilities of the Bridgeport pipe line division and the Bridgeport production district. Construction will be done by Cecil K. Crispin, general contractor from Chrisman, Ill.

Major units in the center will consist of an office building, combination warehouse and locker building, and a garage.

### Pipe Line Contracts Not Let

| COMPANY | Length in Miles | Diameter | Type | Origin and Terminus | Estimated Cost | Status |
|---|---|---|---|---|---|---|
| **Alabama-Tennessee Natural Gas Co.**—Florence, Ala. | 25 | 8, 12 | Gas | Alabama | $808,450 | Proposed |
| **American Louisiana Pipe Line Co.**—666 Penobscot Bldg., Detroit, Michigan | 1,289 | 22, 30 | Gas | North Tepetate, Louisiana—Detroit, Michigan. | $130 million | 1,172 miles Conditionally Authorized |
| **American Pipe Line Corp.**—New York City (Swinerton & Walberg, Engineering) | 1,425+ 485 miles feeders & distribution lines | 24, 26 | Products | Beaumont, Texas, area—Newark, New Jersey | $170 million | Out for bids |
| **Anadarko Basin Pipe Line Co.** | 525 | 24 | Gas | Wise County, Texas—Texas Eastern near Memphis, Tenn. | ..... | Planned |
| **Ar-Mex Pipe Line Co.** | 900 | 8, 12, 14 | Crude | Guernsey, Wyoming—Phoenix, Arizona | $31 million | Planned |
| **Attock Oil Co.** | 60 | .... | Gas | Ohulian Field—Rawalpindi, West Pakistan | ..... | Planned |
| **H. W. Bass & Sons Co.** | 152 | 4, 6 | Products | Duval and Live Oak Counties—Corpus Christi, Texas | ..... | Planned |
| **California-Oregon Pipe Line System** | 103 | 6 | Crude | Crescent City, Calif.—Medford, Oregon | $2 million | Planned |
| **Carolina Natural Gas Corp.**—701 Wilder Bldg., Charlotte, N. C. | 185 | 2, 12 | Gas | North and South Carolina | ..... | Proposed |
| **Central Hudson Gas & Electric Co.** | 48 | 12 | Gas | Albany—Kingston, New York | ..... | Applied to FPC |
| **Cherokee Pipe Line Co.** | 8 | .... | Products | Near Wichita, Kansas | ..... | Planned |
| **Cheyenne Valley Pipe Line Co.** | 58 | 10 | Crude | Lance Creek—Fort Laramie, Wyoming | $1,838,241 | Proposed |
| **Cities Service Gas Co.**—1st National Bank Bldg., Oklahoma City, Oklahoma | 33 | 20, 26 | Gas | To replace lines in Kansas and Missouri | $1,860,000 | Authorized |
| | 13 | .... | Gas | Labette County, Kansas | $285,000 | Authorized |
| | 15.5 | 16 | Gas | Carter County—Garvin County, Oklahoma | $541,050 | Authorized |
| **City of Dalton, Ga.** | 39 | 8 | Gas | To connect with Southern Natural Gas Co. line | $2,940,000 | Proposed |
| **Coast Counties Gas & Electric Co.**—369 Pine St., San Francisco | 40 | 3, 4, 8 | Gas | Coast and Valley region, California | ..... | Planned |
| **Colorado Interstate Gas Co.**—Colorado Springs, Colo. | 365 | 22 | Gas | Rock Springs, Wyoming—Denver, Colorado | $23,299,000 | Authorized |
| | 115 | 4, 6, 8 | Gas | Denver-Julesburg, Basin—Basin Cities | ..... | Before FPC |
| **Colorado Western Pipe Line Co.**—Dallas, Texas | 708 | .... | Gas | Southeastern Colorado Fields—Denver plus laterals | $30 million | Planned |
| | 328 | 16, 18 | Gas | LaPlata County—Pueblo, Colorado Springs and Denver | $21,600,000 | Authorized |
| **Compania del Oleoducto Buenaventura**—Cali, Colombia, S.A. | 90 | .... | Products | Buenaventura—Cali, Colombia | $4 million | Planned |
| **Dixie Pipe Line Co.** | 20 | 8 | Gas | Gwinville Field, Mississippi—Transcontinental Gas line | $425,000 | Proposed |
| **El Paso Natural Gas Co.**—Bassett Tower, El Paso, Tex. | 32.5 | 10 | Gas | Reagan and Upton counties, Texas | $799,000 | Authorized |
| | 74 | .... | Gas | Texas, New Mexico, and Arizona | $13,800,000 | Proposed |
| **Empresa Nacional del Petroleo** | 80 | 6 | Products | Concon—Santiago, Chile | ..... | Planned |
| **Equitable Gas Co.**—420 Boulevard of the Allies, Pittsburgh 19, Penn. | 12 | Various | Gas | Marion and Wetzel counties, West Virginia | $2 million | Authorized |
| **Glacier Gas Co.** | 626 | 16, 20 | Gas | Canada—Montana, Idaho and Washington | ..... | Planned |
| **Gas Service Co.**—Kansas City | 12 | .... | Gas | To connect with Cities Service Gas Co. line | $650,000 | Planned |
| **Governments of Southern Rhodesia and Portuguese, East Africa** | 200 | .... | Products | Beria, Portuguese Mosambique—Umtalia, Southern Rhodesia | ..... | Considered |
| **Home Gas Co.**—Binghamton, New York | 32 | 12 | Gas | Bresport—Union Center, New York | ..... | Planned |
| **Hope Natural Gas Co.**—445 W. Main St., Clarksburg, West Virginia | 33 | 8, 10, 12 | Gas | Wyoming County, West Virginia—Buchanan County, Virginia | ..... | Proposed |
| **Houston Texas Gas & Oil Co.**—4604 Main St., Houston | 1,542 | Various | Gas | Louisiana—Florida | $148 million | Proposed |
| **Idaho Natural Gas Co.**—Goodland, Kansas | .... | .... | Gas | Pacific Northwest line—points in southern Idaho | ..... | Proposed |
| **International Pipe Line Co., Inc.**—227 N. Colfax Ave., Minneapolis, Minnesota | 132 | 8 | Products | Wrenshall, Minn.—Minneapolis Bulk Terminal | $4,250,000 | Proposed |
| **Kansas-Nebraska Natural Gas Co.**—Phillippsburg, Kans. | 221 | 6–12 | Gas | Central and northeast Nebraska | $4,096,890 | Some contracts let |
| **Lateral Gas Pipe Line Co.**—Cedar Rapids, Iowa | 27 | 4 | Gas | Grant—Clarinda, Iowa | $267,000 | Proposed |
| **Malco Pipe Line, Inc.** | 91 | 6 | Products | Prewitt, N.M.—Albuquerque | $1,250,000 | Planned |
| **Manufacturers Light & Heat Co.**—Pittsburgh, Penn. | 51 | .... | Gas | 13 projects in Ohio, Pennsylvania and West Virginia | $4,099,250 | Authorized |
| **Mayflower Pipe Line Co.**—(Pine Tree Natural Gas Co. —70 Pine St., New York, N.Y.) | 200 | .... | Products | New Jersey refining area—New England | ..... | Planned |
| **Michigan Consolidated Gas Co.**—415 Clifford, Detroit 26, Michigan | 25.5 | 12 | Gas | Sparta—Muskegon, Michigan | $13 million | Proposed |
| **Michigan-Wisconsin Pipe Line Co.**—500 Griswold, Detroit 26, Michigan | 252 | 4–24 | Gas | Wisconsin | $11 million | Proposed |
| **Mid-Saskatchewan Pipe Line, Ltd.** | 23 | 8 | Crude | Smiley Field—Kerrobert | ..... | Proposed |
| **Missouri Central Gas Co.** | 25 | 6 | Gas | Moberly—Macon, Missouri | ..... | Proposed |
| **Missouri Public Service Co.**—Warrensburg, Missouri | 136.4 | 8–10 | Gas | New Franklin, Mo.—Grundy County, plus laterals | $5 million | Proposed |
| **Montana-Dakota Utilities Co.**, Minneapolis, Minn. | 56 | 2, 4, 6 | Gas | Hettinger and Stack counties, North Dakota | $728,854 | Authorized |
| **Moore-Stoner Co.** | 200 | 6 | Products | Glendive, Montana—Minot, North Dakota | $2,000,000 | Planned |
| **NATO** | 1,920 | 4–10 | Products | To serve Military bases in Western Europe | ..... | Foster-Wheeler prime contractors |
| **Natural Gas Pipe Line Co. of America**—20 N. Wacker, Chicago | 240 | 24 | Gas | Cater, Garvin and Stephens counties—Hutchinson county, Texas | $30 million | Planned |
| | 280 | 20 | Gas | Wise County, Texas—Amarillo, Texas | $1.5 million | Proposed |
| **Natural Gas Producers, Inc.**—Colorado Springs | 100 | 12 | Gas | Yenter pool—Denver | ..... | Planned |
| **Nebraska Pipe Line Co.** | 220 | 6 | Products | Cheyenne, Wyoming to North Platte, Nebraska | $4,000,000 | ODM Certificate granted |
| **New River Gas Co.** | 50 | .... | Gas | Summers-Monroe Counties, W. Va. and Narrows Dublin, West Virginia | ..... | Planned |
| **NNCW Pipe Line Co.**—Dallas, Texas | 127 | 8, 10 | Crude | Clareton Field—Casper, Wyoming | $3.6 million | Planned |
| **Northern Indiana Fuel & Light Co.**—Auburn, Ind. | 35 | 10 | Gas | Edgerton to Auburn, Ind. | $876,814 | Planned |
| **Northern Natural Gas Co.**—2223 Dodge St., Omaha, Neb. | 167 | 24 | Gas | Farmington, Minn. to Duluth, Minn. and Superior, Wisconsin | $12 million | Before FPC |
| | 329 | 2, 12 | Gas | Sioux Falls to Aberdeen, South Dakota | $6,661,100 | Proposed |
| | 310 | 24 | Gas | Tioga to Fargo, North Dakota | $18,494,000 | Planned |
| | .... | .... | Gas | To interconnect with Natural Gas Pipe Line | $244,000 | Planned |
| **North Dalota Natural Gas Co.**—St. Paul, Minnesota | 500 | 6, 10 & 12 | Gas | Tioga-Minot, Fessenden, Devils Lake and Fargo, North Dakota plus 6" feeder lines | $10.8 million | Proposed |
| **Northwestern Utilities, Ltd.**—10124-104th St., Edmonton, Alberta, Canada | 42 | 12 | Gas | Bonnie Glen—Edmonton, Alberta | $1.4 million | Proposed |
| **Ohio Fuel Gas Co.**—Columbus, Ohio | 24.5 | 20 | Gas | Richland and Crawford Counties, Ohio | $1,072,000 | Authorized |
| | 46 | 20–24 | Gas | Jackson, Vinton, Hocking and Fairfield Counties, Ohio | $3,832,700 | Authorized |
| | 28 | .... | Gas | Various Ohio Counties | $832,700 | Proposed |
| **Orchard Pipe Line Co.**—Denver, Colorado | 45 | 8 | Crude | Orchard-Merino, Colorado | $811,000 | Planned |
| **Pacific Northwest Pipe Line Corp.**—M&M Bldg., Houston, Texas | 1,466+ 443 | Various | Gas | San Juan Basin—Pacific Northwestern states | $160 million | Approved |
| **Panhandle Eastern Pipe Line Co.**—Kansas City, Mo. | 575 | 30 | Gas | Kansas-Michigan | $67 million | 295 miles authorized |
| **Pecos Growers Gas Co.** | 98 | 8, 12 | Gas | Grandfalls, Texas—Reeves County, Texas | $2,500,000 | Has ODM write-off |
| **Petroargentina** | 370 | 16 | Crude | Newguen—Bahia Blanca, Argentina | $40 million | Planned |
| **Petroleos Mexicanos**—Ave. Juarez 94, Mexico City | 440 | 20 | Gas | Brazil-Tampico-Poza Rica, Mexico | ..... | Planned |
| | 260 | 6, 8 | Products | Lagos, Mexico—Guadalajara, Aguascalientes and Salamanca | ..... | Planned |
| | 145 | 12 | Crude | 18 de Marzo Field—Monterrey, Mexico | ..... | Considered |
| | 72 | 12 | Crude | Poza Rica—Atzacapotsalco, Mexico | ..... | Proposed |

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## Pipe Line Contracts Not Let (Continued)

| COMPANY | Length in Miles | Diameter | Type | Origin and Terminus | Estimated Cost | Status |
|---|---|---|---|---|---|---|
| Phillips Petroleum Co.—Bartlesville | 52 | 10 | Products | Shell's Brookshire system—Sweeny, Texas | ..... | Planned |
| | 54 | 6 | Products | Goldsmith—Borger, Texas | ..... | Planned |
| Pine Tree Natural Gas Co. | 204 | 8, 10 | Gas | Boston area—Bangor, Maine | ..... | Planned |
| Pittsburgh Consolidation Coal Co. | 100 | .... | Coal | Cadiz, Ohio—near Cleveland, Ohio | $10 million | Planned |
| Powder River Pipe Line Co.—Casper, Wyoming | 52 | 6, 8 | Crude | Salt Creek and Casper, Wyoming | ..... | Planned |
| Progress Pacific Pipe Line Co.—530 W. 6th St., Los Angeles | 1,100 | 24 | Crude | Odessa, Texas—Los Angeles Harbor | ..... | Planned |
| Santos Jundiai Railway Co.—Brazil | .... | 8, 14, 22 | Crude & Products | Expansion of Santos-Sao Paulo system | $4 million | Planned |
| Shenandoah Gas Co.—Lynchburg, Virginia | 40 | 3, 4, 8 | Gas | Virginia Gas Transmission Co. System—Virginia and West Virginia towns | $1,470,000 | Authorized |
| South Georgia Natural Gas Co. | 368 | 2–12 | Gas | Lee County, Alabama—Georgia and Florida | $8,969,429 | Authorized |
| Standard Oil Co. of Texas | 250 | 6 | Products | El Paso to Albuquerque | $4 million | Surveying |
| Standard Pipe Line Co. | 350 | 16 | Crude | Glendive, Montana—Guernsey, Wyoming | ..... | Planned |
| | 330 | 16 | Crude | Wink, Texas—Albuquerque, New Mexico | ..... | Planned |
| Sturgeon Pipe Lines, Ltd. | 100 | 12 | ..... | Sturgeon Lake Field—Trans-Mountain system | $6,500,000 | Planned |
| Sunflower Pipe Line Co.—Tulsa, Oklahoma | 265 | 3 to 6 | Products | Kearny, Grant and Haskel Counties—Kansas to Wichita, Kansas | $3.5 million | Authorized |
| Tennessee Gas Transmission Co.—Box 2511, Houston 1 | 50 | 10 | Gas | Nueces County, Texas | ..... | Proposed |
| | 243 | 24 | Gas | Hebron Storage Field, Pennsylvania-Greenwich-Connecticut | ..... | Proposed |
| Texas Eastern Transmission Corp.—Texas Eastern Bldg., Shreveport, Louisiana | 481 | 16, 24, 26 | Products | Reconvert "Little Big Inch" line and construct 382 miles of additional line | $7,114,000 | Proposed |
| Texas Gas Corp.—Shreveport, Louisiana | 3.5 | 12 | Gas | Sabine River crossing to join Transcontinental Gas Pipe Line | ..... | Authorized |
| Texas Gas Transmission Co.—416 W. 3rd St., Owensboro, Kentucky | 48 | 26 | Gas | Lake Cormorant, Mississippi—Slaughter, Kentucky | $4,281,135 | Authorized |
| Trans-Canada Pipe Line, Ltd.—Calgary, Alberta, Canada | 2,240 | 30, 36 | Gas | Alberta—Eastern Canada | $297 million | Approved |
| Transcontinental Gas Pipe Line Corp.—3100 Travis St., Houston 6, Texas | .... | .... | Gas | Connecting facilities with Texas Eastern-Penn, Jersey, in Pennsylvania and New Jersey | $131,628 | Authorized |
| | 533 | 30, 36 | Gas | Paralleling portions of Texas-New York line | $80 million | Proposed |
| | 25 | 12 | Gas | Cameron and Calcasieu parishes, Louisiana | $1,076,000 | Proposed |
| Trans-Northwest Gas, Inc. | 246 | .... | Gas | Osoyoos, B.C.—Washington and Idaho, plus 275 miles branch lines | ..... | Planned |
| Triangle Pipe Line Co. | 560 | 12 | Products | Arkansas City, Arkansas—Covington, Kentucky | $24½ million | Proposed |
| Union Oil Co. of Canada, Ltd.—Chatham, Ontario | 180 | 24 | Gas | Dawn Gas Field to Lamberton County to deliver gas to Dominion Gas Co. | ? | Planned |
| United Fuel Gas Co. | 13 | 12, 20 | ..... | West Virginia | ..... | Before FPC |
| U. S. Army Corps of Engineers | 600 | .... | Products | Under study to supply naval and air bases in Spain | $16 million | Planned |
| U. S. Navy | 450 | 8 | Gas | Gubik Field—Fairbanks, Alaska | $20 million | Planned |
| Utah Natural Gas Co. | 40 | 16 | Gas | Orem—Salt Lake City, Utah | ..... | Planned |
| Virginia Natural Gas Co. | 153 | .... | Gas | Buckingham—Richmond and Portsmouth, Virginia | ..... | Planned |
| West Coast Pipe Line Co.—Mercantile Bank Bldg., Dallas, Texas | 900 | 24, 26 | Crude | Wink, Texas—Norwalk, California | $106,000,000 | Planned |
| Williston Basin Pipe Line Co.—Insurance Bldg., Omaha | 244 | 8 | Products | Billings and Laurel refineries—Glendive, Montana | ..... | Out for bids |
| Wyoming Gas Products Corp. | .... | .... | Gas | Gathering system in Weston County, Wyoming, to feed gasoline plant. | ..... | Planned |
| Yacimientos Petroliferos Fiscales Bolivianos | 170 | 4 | Crude | Bermejo—Tupinza, Bolivia | ..... | Planned |

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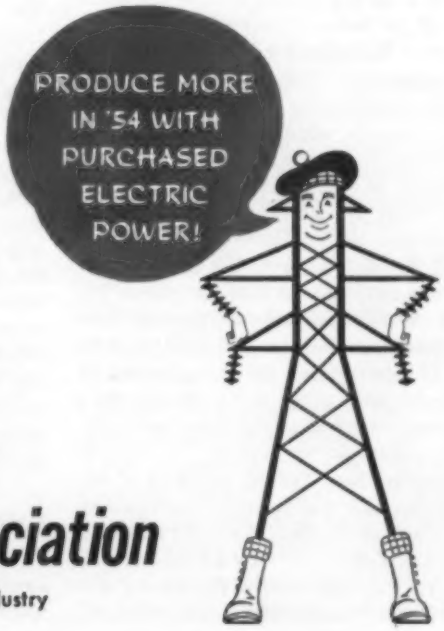


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# PIPE LINE INDUSTRY'S VIEWS OF THE NEWS

## HEADLINES OF THE MONTH

- Industry takes FPC case to the public . . .
- Gatchell reaffirms "escape clause stand . . .
- NPC report emphasizes storage need . . .
- Westcoast appeal delay foreseen . . .
- Depreciation rules issued . . .
- Union merger hopes run into trouble . .

## Industry Pleads a Case

**Oil Progress Week, October 10-16, afforded the oil and gas industry one of its best opportunities to explain to the general public its side of the continuing, serious wrangles over federal controls on natural gas—a topic which long has ranked high on the industry's major public relations program.**

And industry leaders took advantage of an audience made receptive through an extensive nationwide program proclaiming the week as one devoted to general consideration of the industry. One principal aim of the speakers was to fully apprise the public of its own stake in the great debate over federal control of the wellhead pricing of natural gas—similar to the stake that same public has in the tidelands and in depletion allowance.

The Texas Mid-Continent Oil & Gas Association's recent annual meeting at San Antonio offered another chance for the industry to lay its cards on the table. In quick succession, too, industry spokesmen leveled warnings against federal encroachment in the natural gas field.

George T. Naff, president of Texas Eastern Transmission Corporation, said:

"The maintenance of this (abundant) supply requires additional reserves as the population . . . increases. Thus continuing the supply at a static rate is not sufficient. There must be incentives for additional development and for thorough exploration.

J. C. Donnell, II, president of The Ohio Oil Company, warned that the recent Supreme Court decision compelling the Federal Power Commission to regulate field sales of natural gas entering interstate commerce will bring FPC into conflict with state conservation agencies "with producers caught in the middle."

Henry W. Bass, Dallas, president of the association, said that "whether our business retains its freedom or is gradually absorbed into a socialistic state" depends on the outcome of the controversy caused by the Phillips case decision which places federal control over prices paid independent gas producers.

K. S. Adams, chairman, Phillips Petroleum Company, produced pointed considerations of federal gas control in a recent address before the American Gas Association.

In his words, "Those who championed the cause of regulation (of natural gas) are about to learn that they may have won a battle only to lose the war."

Wisconsin and Michigan, principal advocates of federal regulation, were warned time and time again, Adams says, that federal control of gas producers would be detrimental to gas consumers' interests. But they were unmoved.

So, Adams says, "it is ironical that those two states should be the first to feel the pinch of federal regulation which their officers so zealously sought."

**The pinch?** Two proposed 30-inch pipe lines from the Gulf Coast to Michigan and Wisconsin, designed to help meet a part of the anxious and waiting markets, have been deferred.

But, Adams points out, the "pinch" spills over into other fields: huge amounts of steel and other equipment will not be used for thousands of miles of pipe lines; pumping stations and other facilities will not be built; lost will be related construction jobs requiring much material and many hundreds of workers; gas distributors will lose future gas supplies; gas appliance manufacturers and dealers will lose untold numbers of kitchen ranges, heaters, furnaces, water heaters, clothes driers, and other gas-burning equipment; commercial and industrial enterprises will have less gas, older industrial areas will undergo an economic decline as manufacturing industries move to gas-producing states.

## Appeal for the Future

**Westcoast Transmission Company may have to wait until next year to find out when the Circuit Court will hear its appeal from Federal Power Commission denial to grant the company rights to serve the Pacific Northwest with natural gas imported from Canada.**

Westcoast, which proposed to import natural gas from the Peace River area of British Columbia and Alberta, launched a two-pronged attack on two principal FPC's rulings, charging that no intergovernmental agreement assuring continued flow of Canadian gas is necessary under the Natural Gas Act and its program is complete for financing and includes evidence that the proposed pipe line could be built readily and maintained.

## Lease Awards Scheduled

**The Department of Interior hopes to make formal awards by November 1 on the $130 million of bids for leases on submerged oil, gas and sulphur lands on the Continental Shelf off Louisiana's coast.**

Meanwhile, Secretary Douglas McKay is hopeful that federal-state dispute over the boundary line of Louisiana's tidelands can be ironed out by a joint committee of government-state officials appointed last month.

The dispute concerns lands which Louisiana claims but which the Supreme Court, and later the 1953 Submerged Lands Law, vested in the federal government. A major clash was averted when the committee was created. Both the government and Louisiana had advertised some of the same parcels for lease.

One thing is certain: unless the matter is settled amicably, either Congress or the courts will have to reach the final solution. Attorney General Herbert Brownell, Jr., said his aides are studying "the whole tidelands question." He said lawsuits are possible, but he hopes to avoid them.

Louisiana claims her domain extends at least 10½ miles into the gulf in some areas, and 27½ miles in others. Texas claims 10½ miles.

## FPC Stands Pat

**The Federal Power Commission is standing firm on its warning that no independent gas producer can legally invoke an "escape clause" and shut off service to an interstate pipe line.**

Commission General Counsel Willard W. Gatchell reaffirmed this position to WORLD OIL after the Supreme Court, on October 14, refused to reconsider its June 7 decision in the Phillips Petroleum Company case. The decree, which only Congress now can revoke, brought under FPC price regulation Phillips and 4000 other producers who sell to interstate pipe lines.

Gatchell's statement grew out of the action of 14 independent Texas producers who, in September, invoked 30-day escape clauses against the Texas Illinois Natural Gas Pipeline Company, Chicago. The clauses prescribe that contracts can be abrogated when the FPC issues new rules —as it did under the mandate in the Phillips case—regulating production, processing, transmission and sale of gas.

But Gatchell said "these are merely scraps of paper, as far as we are concerned." He added bluntly that escape clauses were outlawed not only by the Natural Gas Act but also by the Phillips decision. "In addition," he said, "all the lawyers I have talked to agree that they have no legal standing."

**The Texas producers** were directed to file answers by October 29 to two formal complaints by Texas Illinois in which it asked the commission to enjoin the producers from terminating service. After the answers are received, said FPC Chairman Jerome K. Kuykendall, "they will be set for hearing and consideration of the entire matter."

But Gatchell doesn't expect any reversal of the commission's stand. Nor does he look for the producers to actually cut off service. "No producer can abandon service or abrogate his contract without Commission approval," he said. "That's the law."

Asked if he regarded the producers' action as a "test case," he replied that "it probably is—and if it is, we're ready to go to court." He hoped, however, that this would not be necessary.

Meanwhile, the commission and gas circles in the nation's capital appeared reconciled to the finality of the Supreme Court decision in the Phillips case. A commission spokesman said the FPC would push ahead with its controversial price-regulation rules until such time as Congress sees fit to change the law.

A spokesman for the Independent Natural Gas Association of America said: "It's now up to Congress. Everything has been pointing that way. The pipe line industry is not disappointed because it anticipated just what the court did, and has been building toward a remedial campaign in Congress."

Another issue of moment to the gas industry comes before the FPC on November 4. On that date, it will open hearings on price-escalator and so-called "Favored Nation" contracts which are now entangled in complexities of the Phillips edict.

# In brief . . .

Competition's unflagging drive has occasioned such a growth in the oil industry that the need for annual investment in new capital is estimated at $5 billion by John W. Boatwright, assistant general manager, Supply and Transportation department, Standard Oil Company (Indiana).

*El Paso Natural Gas Company has filed with Federal Power Commission a rate hike application amounting to $18 million, or 15 percent, which is in addition to the $15.2 million increase now being collected by the company but subject to refund.*

Montana Power Company has filed with Federal Power Commission a request for a permit to import natural gas from Canada for general use in Montana.

**Imminent is Office of Defense Mobilization's report to be made to the National Security Council on need for oil pipe line transportation to the East Coast during any emergency. Likely, the report will follow along lines of an earlier one by the Oil and Gas Division.**

Texas Railroad Commission set the state's November daily crude allowable on a continuing 15-day basis at 2,864,749 barrels, up 64,300 barrels from October 16 permissive flow.

**Sun Oil Company and Atlantic Refining Company are joint winners of the 1954 silver Founder's Medal, an award by the Drexel Institute of Technology in recognition of the companies' "contribution to the industrial vitality of the eastern seaboard and to the strength of the national economy."**

*To be published late this year are results of a nationwide survey of engineering training programs being conducted by an industrial panel. G. W. McCullough, vice president, Phillips Petroleum Company, is the oil industry's representative on the panel for the Professional Engineers Conference Board for Industry project, which is in cooperation with the National Society of Professional Engineers.*

## Depreciation Rules Issued

**Proposed rules putting into effect the liberalization of depreciation for tax purposes approved by Congress in its overhaul of tax laws have been issued by the Internal Revenue Service.**

The new changes will permit the use of the declining balance method of depreciation, or any other similar method which will achieve the same purpose, enabling taxpayers to depreciate about two-thirds of property or equipment cost during the first half of its estimated life. Previously, depreciation has been divided equally over the estimated life of property or equipment.

## Oil To Hold Its Own

**Potential effects of atomic energy upon petroleum industry demands should be quite negligible within the next decade or two, in the opinion of Austin Cadle, manager, Economics department, Standard Oil Company of California.**

Cadle pointed out recently that when this new source of energy is developed for commercial uses on an economic competitive basis, the almost unanimous present opinion of authorities is that it will act in a supplementary role to the use of fossil fuels. Liquid or solid fossil fuels probably could not fully meet requirements of expanding energy requirements, it is thought, so atomic (and possibly solar and other forms of energy) ultimately will be needed in large volumes.

Finding the amounts of petroleum which will be called for, according to Cadle, constitutes a physical and financial problem of proportions far greater than we have ever faced in the past. There is every indication, he said, that there is a "fascinating brillant future" for petroleum.

## Defense Units Picked

**Dr. Robert E. Wilson, chairman, National Petroleum Council Committee on Oil and Gas Emergency Defense Organization, has appointed two subcommittees on Continuity of Company Operations and Advance Preparations and Plans. The chairman of the board of Standard Oil Company (Indiana) appointed H. G. Mangelsdorf, Esso Standard Oil Company, as chairman of the subcommittee on continuity, and R. G. Arner, Sinclair Oil Corporation, as chairman of the subcommittee on advance planning.**

The parent committee is investigating ways and means of meeting oil and gas industry crises which might result from an enemy attack as well as means of rehabilitating losses to assure the U. S. of adequate post-attack supplies of oil and gas.

## Storage Need Emphasized

**The 1954 report of the Committee on Petroleum Storage Capacity re-established the industry's inherent need for large storage capacity in relation to the amount of crude oil and products moving into and out of such storage in order to conveniently and economically supply the current and forward requirements of customers.**

This report, presented at the October meeting of the National Petroleum Council, Washington, D. C., by L. S. Wescoat, committee chairman, indicates that 100 barrels of storage is required for every 47 barrels of inventories contained therein, if the industry is to enjoy complete flexibility at all times in normal operations. The 1952 ratio was 100 barrels of storage to 45 barrels of inventories.

Total storage capacity reported for crude oil, clean products and residual fuel was 991 million barrels, more than half of which was assigned to clean products —gasoline, kerosine and distillate fuel oils.

**Another point** confirmed by this survey, as in others, said Wescoat, is the large portion of total reported inventories that are unavailable for shipment, i.e., those wrapped up in the industry's far-flung manufacturing, storage and transportation systems, that must be kept intact if the industry is to function. On March 31 these unavailables totaled almost 273 million barrels, or 50.7 percent of the 538 million barrels that were reported as in crude oil, clean product and residual inventories.

Included in the survey for the first time was a study of the underground storage capacity of the industry. Only figures reported were in connection with LPG or LRG, and the total for the U. S. was about 5½ million barrels as of March 31, almost half of which was found to be in Texas inland area.

## Union Merger Balked?

**What has happened to O. A. (Jack) Knight's much-ballyhooed, in-the-bag merger of his CIO Oil Workers with Elwood Swisher's CIO Chemical Workers?**

Things seemed all set when, suddenly, the bottom dropped out of plans for a joint merger convention at Cleveland November 15-17. Also, Knight's vision of a million-man coalition of oil and chemical workers has become a mirage and may fade into oblivion.

While Knight and Swisher both insist the merger will go through—even though belatedly—all is not rosy and it could be that President Dave McDonald of the powerful CIO United Steel Workers, is the difference.

McDonald, whose distaste for CIO President Walter Reuther is no secret, is supposed to have offered Swisher a cool million dollars to align his United Gas, Coke & Chemical Workers with the USW. This would serve three purposes: arm Swisher with enough money for a big organization drive and make him independent of Reuther's bounty; cut the ground from under the OWIU-UGCCW merger; and "take a fall" out of Reuther who has been pushing the merger as the nucleus of a future CIO union that would dominate the oil, chemical, and related fields.

**It is well known** that McDonald would like to see Reuther replaced as head of the CIO. McDonald denied, at the recent USW convention in Atlantic City, that he was "out to get" Reuther. But talk has that as his objective, and his reported offer to Swisher could be a devious way of going about it. In other words, a sort of divide-and-conquer strategy.

Swisher's executive board met in Washington October 11-12. It was supposed to put its final OK on the new OWIU-UGCCW constitution ratified at the September convention in St. Louis. Vigorous and vociferous opposition developed instead.

Upshot of this was that the board decided to delay the joint convention with the oil workers until some time in March. This knocked Knight's plans into a cocked hat and he, too, ordered his ratification convention postponed until March.

In the interim, Knight has called a November 4 meeting of his strategy board to map plans for a 5 percent wage drive. The meeting will be held in Denver, OWIU headquarters. It is presumed, however, that the main topic will be the faltering merger.

**The UGCCW** St. Louis convention ratified the combine only after Reuther warned bluntly that, unless it went through, he would deprive Swisher of much-needed organization money.

A UGCCW spokesman in Washington, when asked if the consolidation was in danger because of McDonald's reported offer, said he didn't know. But he also suggested that PIPE LINE INDUSTRY ask McDonald whether he was going to back up his million-dollar proposal with "deeds instead of words."

Thus it would seem, at least on the surface, that McDonald has tossed a big wrench into the merger machinery. Time will tell. Meanwhile, the AFL and independent unions Knight had depended upon as future members of his big coalition, have pulled into the shadows. Knight's only explanation was that he won't put real steam behind this campaign until the OWIU-UGCCW combine is in the bag.


**WALWORTH VALVES on the job on pipelines**

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For more information on the complete lines of Walworth Valves for pipeline service see your nearby Walworth Distributor or write to: Walworth Company, General Offices, 60 East 42nd Street, New York 17, N.Y.

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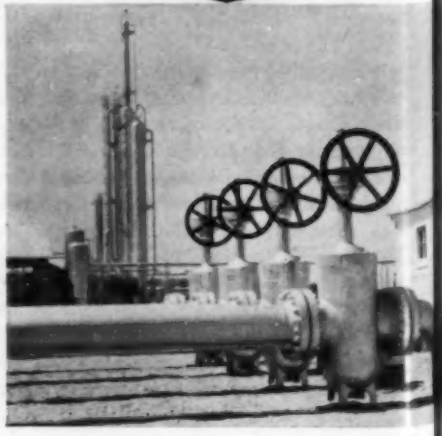
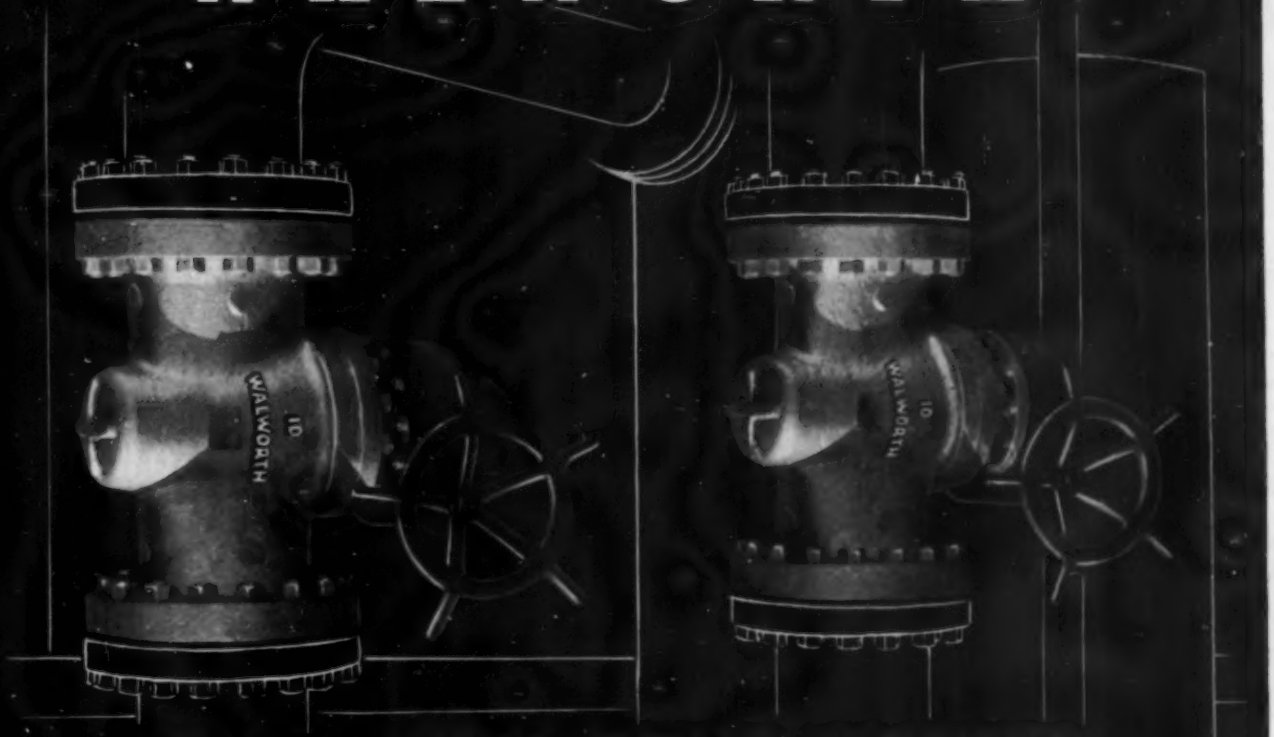


# WALWORTH

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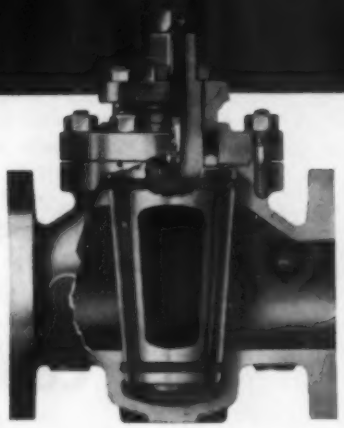

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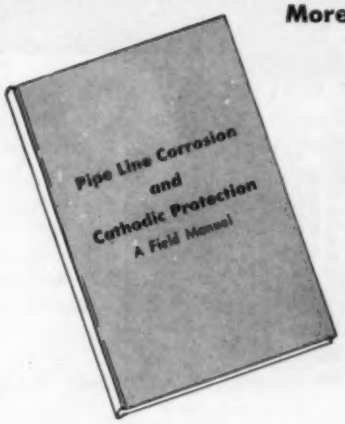
**More comments on this new Handbook:**

"... a most practical on-the-job manual for men concerned with pipe line corrosion. We are ordering copies for each of our district engineers."




# Pipe Line Corrosion and Cathodic Protection

By MARSHALL E. PARKER

This Handbook, written by Marshall E. Parker, consultant, is designed as a practical field manual. It is a 108-page pocket-size volume printed first as a popular series in WORLD OIL. The Handbook is illustrated with many charts and drawings and is completely indexed by subjects.

It presents comprehensive data on Soil Resistivity Surveys, Potential Surveys, Line Currents, Current Requirements, Rectifier Systems, Ground Bed Design, Magnesium Anodes, Stray Current Electrolysis, Interference in Protective Systems, Operations and Maintenance, and Coating Protection and Testing.

An appendix has been added of technical data on Underground Corrosion, Basic Principles of Cathodic Protection, Properties of Metals and Attenuation Equations. Order copies of this practical Field Manual now for each of your field men. Price $3.

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## Optimism—and Why

**The world may enjoy the greatest economic development in history during the next ten years.**

This optimistic view was offered recently by B. Brewster Jennings, president of Socony-Vacuum Oil Company, Inc., in an address before The Los Angeles World Affairs Council.

Of acute interest to the oil industry at large are the reasons which this expert gives for his optimism. Speaking on some aspects of the overseas operations of American oil companies, whose capital investments are estimated at more than $4 billion, Jennings, said the subject bears importantly, in several ways, on the well-being of all, "as neither our standard of living nor our national security can be supported without an abundance of oil for ourselves and for those nations that stand with us."

Reasons for an optimistic outlook, said Jennings, are:

- The successful conclusion of the recent Iranian oil negotiations, which will help revive Iran's economy, make it a strong friend of the West and preserve to the free world a great supply of crude.
- Continued growth in the free world economy generally.
- Plenty of oil is in sight in the sense of proven reserves and ability to produce.

## NLRB Rules on Stock Plan

The National Labor Relations Board has put all industry on notice that once a corporation sets up a stock purchase plan for its union employes and to which it contributes, the plan thereafter becomes a legal collective bargaining issue.

The far-reaching decision, rivaling only that in the Inland Steel Company case in 1948, was handed down by a 3 to 1 vote against the Richfield Oil Corporation, and in favor of O. A. (Jack) Knight's Oil Workers International Union (CIO).

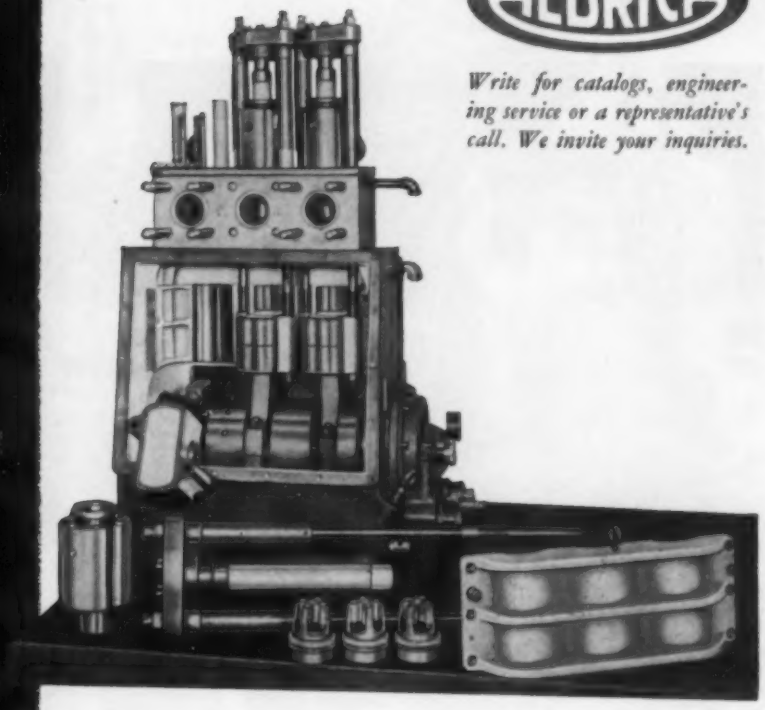
In 1953, more than 30 corporations had such plans, covering millions of workers.

The board majority held that the Richfield plan "came within the meaning of wages and other conditions of employment." It said the Labor Relations Act requires an employer to bargain on these matters.

Richfield—supported by a brief filed by the Chamber of Commerce of the U. S.—argued that such bargaining constituted undue interference in management affairs by union control of employes' voting rights as stockholders.

The decision came in the face of recent charges by organized labor that the NLRB was "stacked" against the working man. Voting against Richfield were Chairman Guy Farmer and members Ivar H. Peterson and Philip Ray Rodgers. Member Abe Murdock did not take part and Member Albert C. Beeson dissented.

# Why ALDRICH PUMPS Reduce Maintenance Cost



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**Design simplicity . . . rugged construction**

Aldrich Pumps are built to take punishing service year after year. You can find Aldrich Pumps, today, in good running order after 30, 40 and even 50 years of service. Durability such as this is the result of Aldrich's design simplicity and rugged construction.

**Accessibility . . . sectionalization**

When wearing parts are due for replacement, in Aldrich Pumps they can be replaced easily, quickly and at low cost. For instance, manifolds can be moved out on the holding studs and you can lift out and replace valves as complete units. . . . Stuffing boxes are particularly accessible—making it easy to renew packing. . . . To meet a change in pressure or capacity requirements, plunger sizes can be changed — in most cases merely by using new glands, throat bushings and packing in the same fluid-end. . . . Wearing parts are interchangeable among pumps of the same stroke size. . . . Fluid-ends are sectionalized to make possible low cost parts replacement and can be made of stainless steel, bronze, Monel or other material.

**Aldrich Pumps Are Used For:**

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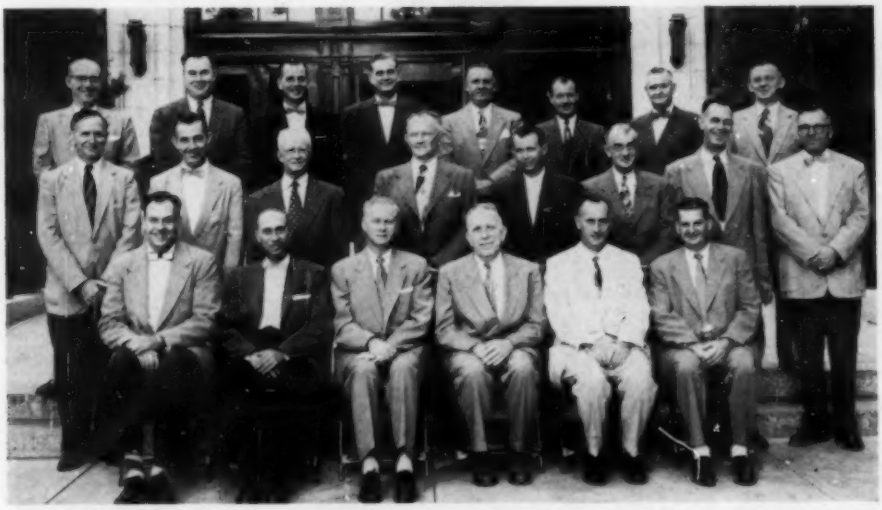
# Pipe Line Men

## IN THE NEWS



***Sinclair Safety Supervisors Meet***

Motivating employes to greater safety consciousness was the theme of Sinclair's sixth annual safety symposium held in Independence, Kansas, in October. Attending from Sinclair Refining Company, Richfield Oil Corporation, Sinclair Research Company and Sinclair Pipe Line Company, were, front row, left to right, D. F. Wilson, M. J. Neterer, W. W. Hitchcock, D. F. Cheaney, I. T. Fritz and C. H. Lindberg. Second row, W. F. Hudiburg, H. T. Hancock, A. B. Geren, K. B. Henry, O. H. Ruhmann, W. W. Johnson, A. H. Hutchins, and H. G. Roessner. Third row, J. W. Baldwin, R. H. King, J. R. Nolan, C. C. Collins, W. H. Winters, O. W. Holloway, J. W. Johnston, and E. O. Brace.

**George H. Rabson,** formerly with **Pan American Production Company** 15 years, and recently technical assistant to the chief production engineer of that company, has been named chief reservoir engineer of the Gas Supply department of **Transcontinental Gas Pipe Line Corporation.** His headquarters will be in Houston, Texas.

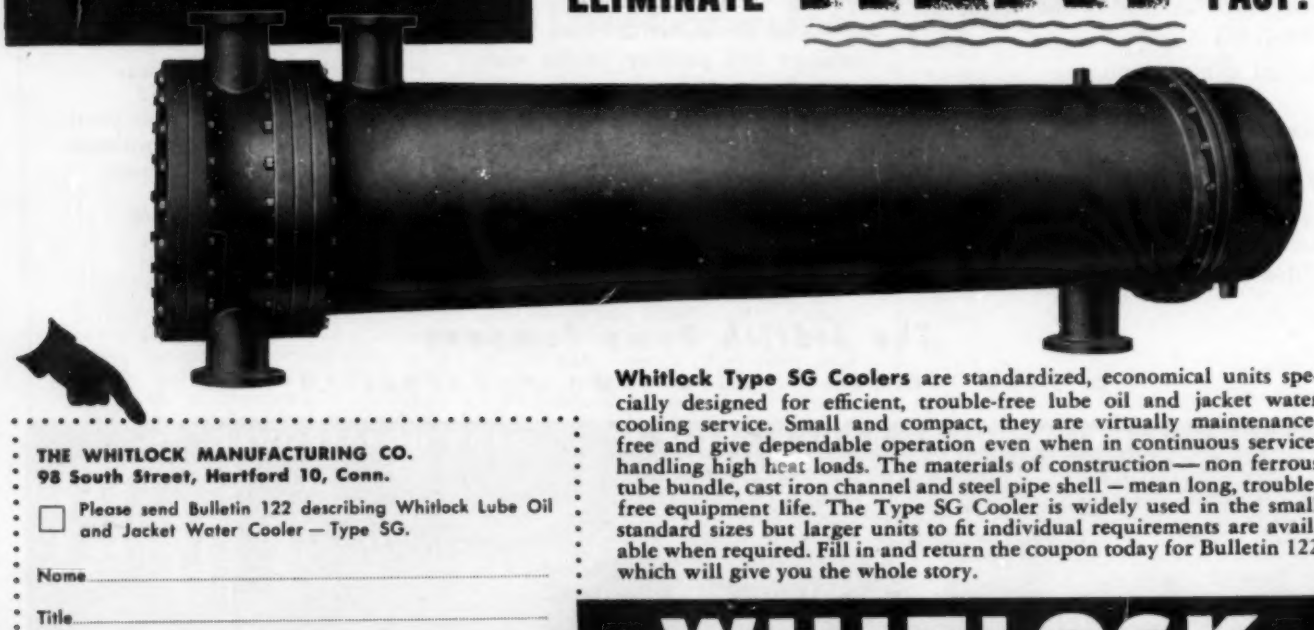
•

**O. V. Summers,** division superintendent, communications division, **The Texas Pipe Line Company,** who has been with Texaco more than 40 years, retired July 1.

He has been active in the Petroleum Industry Electrical Association from the time it was organized in 1928 and served as president in 1941. He also is retiring as head of the communications division, Texas-New Mexico Pipe Line Company.


PIPELINE COMPRESSOR STATIONS

ELIMINATE HEAT FAST!



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**N. B. Mavris,** Ponca City, Okla., has been promoted to the newly created position of superintendent of **Yellowstone Pipe Line Company,** with headquarters in Spokane. He formerly was assistant chief engineer for Continental Pipe Line Company.

N. B. Mavris

Mavris will direct operations of the new 540-mile Yellowstone line from Billings, Mont., to Spokane. A native of Oklahoma City, he joined Continental Pipe Line Company at Ponca City in 1951. He was promoted to assistant chief engineer in 1952.

•

Effective January 1, 1955, **Standard Oil Company (Indiana)** will have a Transportation and Supply department as a main branch of its organization. General manager will be **Dr. Robert C. Gunness,** who is at present assistant general manager—manufacturing, and a member of the board of directors.

The new department will combine the operations of the present Purchasing, Traffic and Distribution Economics departments. It will also take over products pipe line, the marine, and distribution terminal operations which are now handled by Manufacturing, Sales or Production departments.

Gunness, a graduate of Massachusetts Institute of Technology, joined Standard in 1938.

•

**E. Russell Griffith,** formerly with the Gas department of Ford, Bacon and Davis, Inc., has joined the **American Gas Association** as research engineer. He will assist **T. L. Robey,** coordinator of research for A.G.A. under the gas industry's coordinated promotion, advertising and research plan and will be employed primarily on pipe line research work.

At Ford, Bacon and Davis, Griffith worked on gas field reserves and deliverability studies, natural gasoline plants, natural gas pipe line design and related economic studies, compressor stations, petroleum products pipe lines and chemical process design.


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RIDGID Work-Saver Pipe Tools

**W. F. Knode** is new general manager of the **Alberta Gas Trunk Line Company, Ltd.** Knode assisted in organizing the first Alberta conservation board.

**Alberta Gas Trunk Line Company** recently established temporary offices in Calgary. **R. J. Dinning** has been elected chairman of the company's provisional board and **W. J. Knode** is general manager of the company.

•

**David E. Day,** vice president of **Richfield Oil Corporation,** has been elected a director of **Trans Mountain Oil Pipe Line Company** to replace **S. D. Bechtel,** who resigned.

•

**P. McDonald Biddison,** gas industry consultant and former vice president of Trunk Line Gas Supply Company, has become president of **Texas-Ohio Gas Company.** He will also serve as a director of the company. **Frank Champion,** former president of Texas-Ohio, resigned but will continue to serve as chairman of the board and a director.

B. G. Christopher

Larry D. Jackson

H. T. Chilton

**B. G. Christopher** and **Larry D. Jackson,** from Magnolia Pipe Line Company, and **H. T. Chilton,** from Service Pipe Line Company, have been loaned to the U. S. Defense department during construction of a major pipe line project in France.

Christopher, mechanical engineer with Western division of Magnolia, will serve as resident engineer and Jackson, welder foreman at the company's Corsicana, Texas, terminal, will serve as field engineer.

Chilton, executive assistant to the vice president of operations of Service Pipe Line, will serve as technical and engineering counsel on the project.

The products line is being laid from the Atlantic port of St. Nazaire to Metz, near France's northern frontier. The line is being constructed, under authority of the Joint Construction Agency of the U. S. European Command, to supply American and French installations in the Metz sector.

•

**Powell O. Morgan,** Hot Springs, Ark., has been named Arkansas district manager for the recently organized **Valley States Oils, Inc.** For the past three years he has been refined fuels representative for the Berry Asphalt Company.

Valley States was organized by Sunray Oil Corporation, Tulsa, and Kerr-McGee Oil Industries, Inc., Oklahoma City, to distribute the petroleum products of these two companies consigned to the new Oklahoma Mississippi River Products Line, Inc.

*In this business— as in every industry— leadership depends on quality of product.*

The importance of plastic linings to prevent pipe corrosion, resist paraffin deposition, and provide more flow with less friction is recognized throughout the oil industry.

But all plastics are not alike. When the useful life of equipment costing thousands depends on the plastic lining used, it is sound business judgment to demand the best.

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**G. L. Maciula** has been transferred to Galesburg, Ill., as assistant division manager for Service Pipe Line Company, Illinois division.

He will assist J. J. Willenburg, division manager, with work incident to modernization and electrification of pump stations. Maciula had been the company's assistant division manager for southern Oklahoma since 1952.

**W. N. Stivers,** Shawnee, assistant division manager for northern Oklahoma, was named assistant division manager for all of the Oklahoma division.

•

**Frank A. Rothwell** of Iowa, La., industrial sales representative for **United Gas Pipe Line Company** since 1933, has been transferred to the San Antonio district.

He succeeds **W. M. Stephens,** who was recently transferred and promoted to Houston division sales manager for United Gas.


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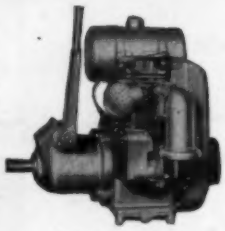
**TROUBLE-FREE, ALL WEATHER AIR-COOLING . . .**

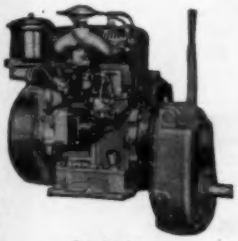
No machine is any better than the Power that drives it. And efficient cooling, under all operating conditions, is one of the first essentials to dependable power! A large capacity fan, cast in the flywheel of every Wisconsin Engine, provides trouble-free cooling, even in the most extreme temperatures.



Single-cylinder 3 to 9 hp.

**TAPERED ROLLER BEARINGS AT *BOTH ENDS* OF CRANKSHAFT . . .**

These self-cleaning, file-hard bearings take up all load thrusts, permitting the use of either chain-, belt- or gear-drive direct from the extended crankshaft, without fear of damaging main or connecting rod bearings. This does away with the need for an outboard bearing.



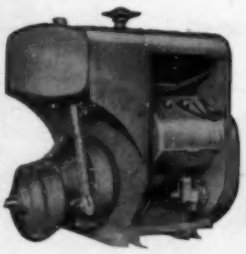
2-cylinder 7 to 15 hp.

**HIGH TENSION, ROTARY TYPE OUTSIDE MAGNETO . . .**

Positive gear drive direct from camshaft assures steady, uniform ignition at all times. The complete unit is conveniently mounted on the OUTSIDE of the engine for easy accessibility. Weather-sealed against moisture and dust. Equipped with Impulse Coupling for quicker, easier starting at all seasons.

**POSITIVE, PUMP-CIRCULATED LUBRICATION . . .**

All single cylinder models (with exception of Model AEN) have pump-circulated level splash system. Model AEN and multi-cylinder models pump an individual oil stream to each connecting rod. Other parts are lubricated by oil spray, assuring complete and thorough lubrication for smooth-running and long engine life.



4-cylinder V-type 15 to 36 hp.

• *These are some of the reasons why it pays to specify "WISCONSIN AIR-COOLED ENGINES" for your Oil Field Equipment.*

**WISCONSIN MOTOR Corporation**
MILWAUKEE 46, WISCONSIN
*World's Largest Builders of Heavy-Duty Air-Cooled Engines*

*WRITE TO HARLEY SALES CO.*
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OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS


**Herbert R. Straight,** former chairman of the board of **Cities Service Oil** and **Cities Service Pipe Line Company,** recently was honored at a dinner given by officers and directors of Cities Service Oil Company in acknowledgment of his 65 years of service in the petroleum field. Straight moved to Oklahoma in 1911 to help manage the old T. N. Barnsdall properties, and shortly thereafter, joined a group of producing companies which later became Cities Service Oil Company. He was elected president of Cities Service Oil Company (Del.), Cities Service Pipe Line Company and Cities Service Gas Company in 1937. In 1946 he was named board chairman for Cities Service Oil and Cities Service Pipe Line. December 31, 1947, he resigned from active participation in company affairs and, since, has served as director of both Cities Service Oil Company (Del.) and Cities Service Company.

Herbert R. Straight

•

General manager of **Minnesota Pipe Line Company** is **Edward C. Mishou,** formerly assistant to the Southern Division manager for Interstate Oil Pipe Line Company. Mishou is a graduate of the University of Kansas.

**Miss Bettye M. Bohanon** has been named treasurer and assistant secretary of the company. For the past five years she has been secretary and treasurer of Conorada Petroleum Corporation in New York City.

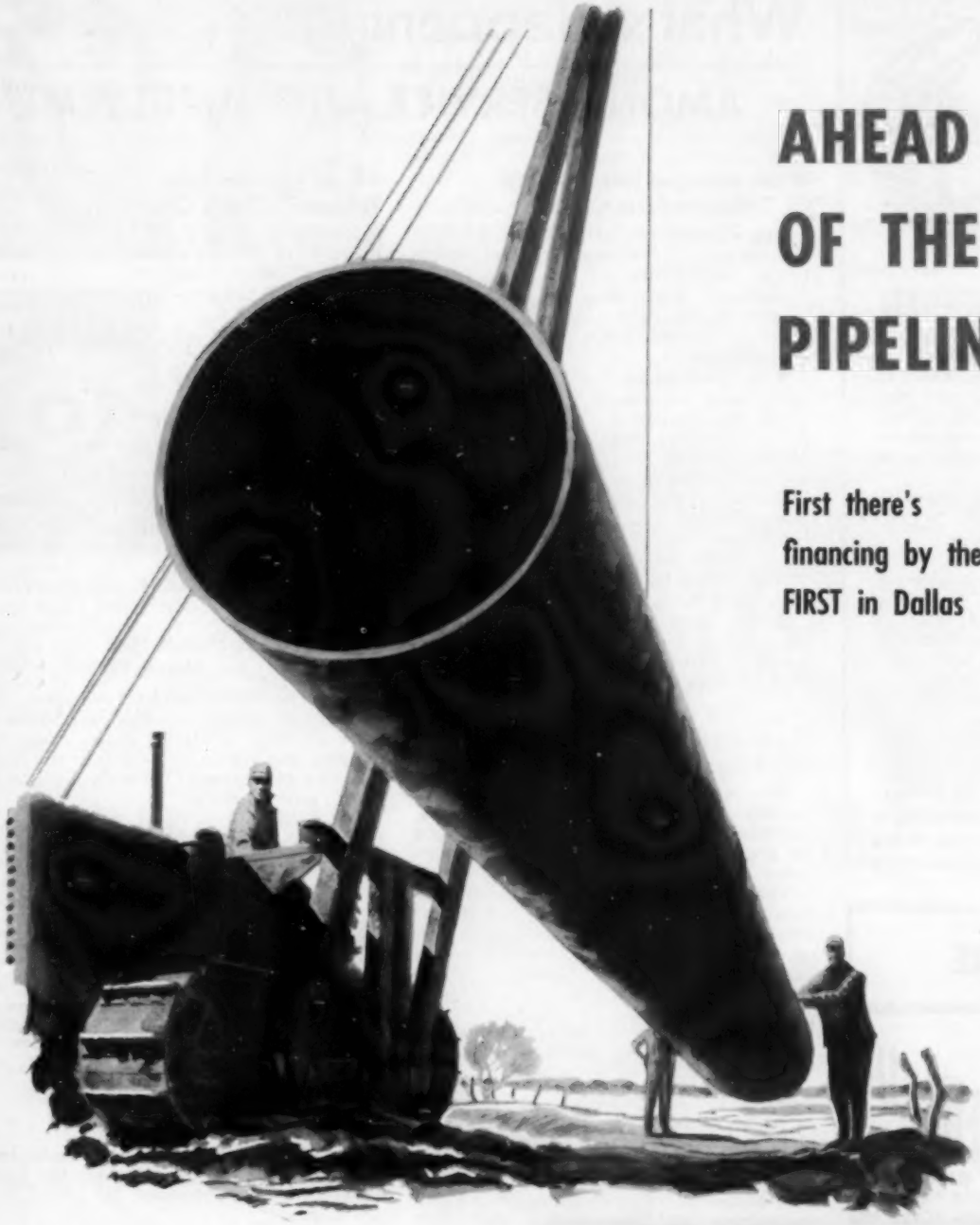
Headquarters for Minnesota Pipe Line are in St. Paul, Minn.

•

**Paul N. Templeton** has been named supervisor of tariffs and oil movements and will head a newly-established oil movements department for **Magnolia Pipe Line Company.**

The new department will make all shipping arrangements for crude oil and petroleum products transported by pipe line.

Templeton will have under his supervision **R. L. Council,** chief dispatcher, and **J. J. Harris,** who has been made coordinator of oil movements.



# AHEAD OF THE PIPELINE

First there's financing by the FIRST in Dallas

THE SOUTHWEST'S PIONEER OIL BANK

*Give us an opportunity to say YES*

# FIRST NATIONAL BANK IN DALLAS

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION




For more data on advertised products, use Readers' Service Cards, last page.

The First Completely

**SAFETY-ENGINEERED PIPE LINE SLING**

GREENHEAD SLINGS have approximately 100,000 lbs. more strength than ordinary slings. GREENHEAD SLINGS give you lower cost, greater durability, lighter to handle, easily operated by one man.

- 10 ply belting covers ropes on pull-out side
- No stretch to tear pipe wrapping
- Cable Protector saves wire ropes
- Tough, cast, bearing-plates
- 4-9/16" wire ropes in basket hitch, 222,400 lbs. ultimate strength
- Completely eliminates the old ball and pins

Write us about your special sling requirements

**GREENHEAD SLING AND SUPPLY COMPANY**

3912 Leeland Houston, Texas



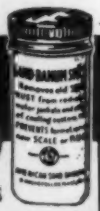
**BE SURE**

**SAND-BANUM**

REMOVES AND PREVENTS BOILER SCALE AND CORROSION

Ounces Only Once a Week

**SAND-BANUM SPECIAL**



TABLETS REMOVE AND PREVENT RUST AND SCALE IN ALL RADIATOR COOLING SYSTEMS

POWER GOES UP MAINTENANCE GOES DOWN

AMERICAN SAND-BANUM CO.

Established 1926

9 Rockefeller Plaza New York 20, N.Y.


# What's Happening

## AMONG SERVICE AND SUPPLY MEN

### Wilde Manages Sales Division Of Tellepsen Petro-Chem

Appointment of Stafford H. Wilde as division sales manager of Tellepsen Petro-Chem Contractors, a division of Tellepsen Construction Company of Houston, has been announced.

Stafford H. Wilde

From 1930 to 1945 Wilde was associated with the Henry J. Kaiser Interests, employed on such projects as Hoover Dam, Delaware Water Aquaduct for the city of New York, and the U. S. Naval Air Station at Corpus Christi.

In 1945 he organized the Bellco Industrial Engineering Company in Houston and served as vice president and director of this organization until his resignation in September.

### Corrosion Services Handle Dow Magnesium Anodes

Dow Chemical Company has named Corrosion Services Incorporated of Tulsa, distributors for Dow magnesium anodes for protection of underground and underwater structures.

The company will also distribute cathodic protection equipment and instruments and will serve as a consulting service on corrosion problems to industry throughout the U. S.

### Northern Natural Awards Contract to Tuloma Builders

First contract awarded to Tuloma Builders, Inc., of Tulsa since their organization in mid-August, is for the building of 11 metering stations in central Iowa for Northern Natural Gas Co.

Top personnel of Tuloma formerly were with Midwestern Constructors, Inc., Tulsa engineering and construction firm. All work formerly handled by Midwestern's Engineering and Plant Construction department will be handled by Tuloma.

### Hinkle Receives Sales Post With Reilly Tar & Chemical

Robert S. Hinkle has been named a member of the protective coating sales group of Reilly Tar & Chemical Corporation.

R. S. Hinkle

A graduate of the University of Illinois, Hinkle served in the U. S. Army Air Force during World War II. He will have headquarters in Granite City, Ill., where he will be associated with the Reilly group headed by E. E. Goodman, district manager.

### National Tube Names New Sales Manager—Plastic Pipe

Robert K. Henderson has been appointed manager of sales-plastic pipe for National Tube Division of United States Steel. In this new position he will supervise the sales activities of National Tube division's new plastic pipe products.

Henderson began with United States Steel in the Open Hearth department of Duquesne Works of the former Carnegie-Illinois Steel Corporation. He transferred to National Tube in 1936 as salesman in the New York district sales office and in 1952, returned to the Pittsburgh district as manager of market development.

Succeeding Henderson as manager of market development is Samuel W. Verner who has been with National Tube division since 1952.

### Holcombe Company Appoints Gulf Coast Representative

Tod Pazdral Pipeline Specialties has been appointed representative for the Holcombe Co., Inc., distributor for Lion Pipeline Enamels.

The Tod Pazdral Company is also representative for T. D. Williamson, Inc., in all the Gulf Coast area except West Texas.


**NOTICE:** Specify **PELCO** Welding Saddles

No change except the corporate name. We still have the same ownership, same management, same address, same telephone, and use the same 45 years of experience to render the same service under the same trade name—"PELCO."

**PELICAN SUPPLY CO. INC.**

P. O. Drawer 1108 Shreveport (84), La.

SEE YOUR NEAREST SUPPLY HOUSE

H. H. Hippler

Don L. Herring

## Gar Wood Industries Promotes Hippler, Herring and Howerth

Gar Wood Industries has announced the appointment of H. H. Hippler as assistant director of sales and service administration. He will be responsible for sales administration and service functions involving all corporation products, including truck and construction equipment.

H. J. Howerth

Hippler, with Gar Wood for 30 years, started as a Parts department clerk in 1924. He was appointed division manager of Gar Wood's branch division in 1949.

New district manager for tractor equipment sales is Don L. Herring, who's territory includes Florida, Georgia, Alabama, North and South Carolina and Tennessee. His headquarters will be in Atlanta.

New product sales manager for Gar Wood truck winches and cranes is H. J. Howerth. He joined the firm as sales engineer in 1946.

## Honeywell Regulator Buys Heiland Research of Denver

Minneapolis-Honeywell Regulator Company has purchased the assets of Heiland Research Corporation of Denver, manufacturer of precision scientific instruments and high quality photographic flash equipment.

The 20-year-old Denver firm, to be operated as a new Honeywell division, will continue in its Denver plant and offices with the present production, administrative and sales personnel. The Heiland part of the name will be retained. Stephen A. Keller has been named general manager of the new division.

Marshall B. Taft will succeed Keller as general manager of the Valve division of Minneapolis-Honeywell. He was formerly assistant to the president of the firm's industrial division in Philadelphia.

## Royce and Merriett Manage New Gar Wood Sales Branches

Two new direct factory truck equipment sales branches, in Tulsa, and Springfield, Ill., have been opened by Gar Wood Industries of Wayne, Mich. Both branches will distribute the complete line of Gar Wood truck equipment.

The Tulsa branch will continue to operate, also, as the parts depot for Gar Wood-Buckeye ditcher and excavator parts. D. C. Royce who has managed the depot since 1950 has been in Buckeye sales since 1910.

The Springfield branch will continue to operate as a mounting station for the company's bulldozers and power control units. Carroll Merriett has managed the station since 1951. He started with Gar Wood in 1944 as a service representative.

## American Locomotive Company Names Southern Sales Manager

The appointment of Richard K. McCoy of Washington, D. C. as southern district sales manager for American Locomotive Company has been announced. McCoy will make his headquarters in Alco's Washington office and will be responsible for sales of commercial products in southern and southeastern states.

## Peerless Manufacturing Company Appoints Brown Sales Engineer

Peerless Manufacturing Company of Dallas has announced the appointment of Edward F. Brown as sales engineer for both Peerless and its subsidiary, Sillers Engineering Company.

E. F. Brown

Brown, who has worked in the Engineering and Sales departments at Peerless, will handle the sales activities of both companies in the North Texas area, including Dallas and Fort Worth.


*Announcing the* **NEW . . .**

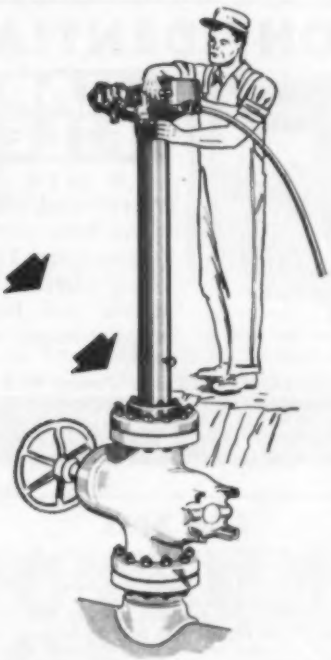
ASA 600# RING JOINT FLANGE PERMITS **PRESSURES TO 1,440 P.S.I. @ 100° F. TEMPERATURES TO 700° F. @ 700 P.S.I.**

**WmSON-HILLCO MODEL 660 TAPPING MACHINE***

*FOR MAKING CONNECTIONS TO PIPELINES AND TANKS WITHOUT SHUTDOWN OR DRAINAGE*

★ 42" TRAVEL LENGTH OF BORING BAR *permits . . .*
**PIPE TAPS TO 14" SIZE**
**TANK TAPS TO 16" SIZE**

★ CHOICE OF POWER
compact air motor or complete hydraulic drive (including engine driven pump) provides dependable lower cost power.



* Patent No's. 2,679,173—2,097,398
Write for bulletin number A-702 on your company letterhead

T. D. Williamson, Inc.
P. O. BOX 4025 TULSA 9, OKLAHOMA

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Houston • Pittsburgh • Kenilworth, N. J. • Amarillo • Casper • Provo, Utah • Los Angeles
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PIPE SADDLES AND REDUCERS

Nozzle sizes from ¼" to 24"

ASTM A234

Also for pressure vessel heads

Nominal pipe sizes 1" to 30"

Special sizes and lengths. Schedules 10 to 160

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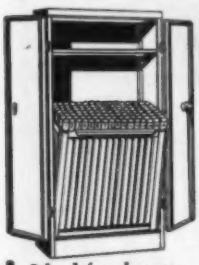
CONFIDENTIAL



MAP FILE

# MT4

Metal cabinet map file with locking doors. 112 tilting tubes. Easy to file and find maps, tracings to 60".

*Ideal for home and field offices.*

PATENT NO. 1610368 Other Patents Pending

SCOTT-RICE COMPANY

610 S. Main Tulsa 3, Okla.

FOR SALE

New American Wheelabrator Cabinet Roto-Grit Blast Pipe Cleaning Machine. Original cost approximately $24,000. Will sell at a substantial reduction.

This machine is designed to clean pipe from 2" to 12" in diameter in lengths from 10' to 50'. It can also be changed to handle larger sizes of pipe by increasing openings in each end.

Equipped with double wheel operation for fast cleaning, also automatic lifts, and dust disposal unit.

Machine is powered for 440-volt 60-cycle 3-phase current.

For further information
phone ATlantic 1-9320 or write

THE MANUFACTURERS LIGHT AND HEAT COMPANY

Att: W. L. HUTCHESON

Post Office Box 1196
Pittsburgh 30, Pennsylvania

## Thornhill-Craver Appoints O'Neil Sales Representative

Thornhill-Craver Company has announced the appointment of W. C. (Bill) O'Neil as a sales representative in the Houston territory. O'Neil will cover the East Texas and Gulf Coast area.

W. C. O'Neil

O'Neil has had a number of years experience in the oil equipment field. He was a sales representative for Gulf Supply Company for three years prior to joining Thornhill-Craver and was in the Engineering department of W-K-M for five years.

## B-I-F Industries Opens Sales And Service Offices in Texas

B-I-F Industries, Inc. has announced the formation of a new Texas division with sales and service offices in Houston and Dallas.

Known as B-I-F Texas, Inc., Southwest Division of B-I-F Industries, Inc., the new division represents Builders-Providence, Inc., Omego Machine Company, and Proportioneers, Inc.

The main office in Houston is staffed by John B. Mackenzie, Jr., a vice president of B-I-F Texas, Inc., Charles J. Wolfer, Raymond W. McIndoe, Jr. and Mrs. Lollie R. Lowe.

Dallas office includes Edward Morey, Jr., also a vice president of B-I-F Texas, Inc., Lewis H. Johnson, Mrs. Floy Brazell, Richard L. Lauderdale and Clem D. Hoye, Jr.

## European Experts Named To Top Nordberg Posts

Appointment of Hans U. Lieberherr as director of engineering, Emil Grieshaber as director of projects development, and Ralph Miller as consultant and director of supairthermal development and application, heavy machinery division, is announced by Nordberg Manufacturing Company, Milwaukee, Wis.

Lieberherr, born in Switzerland, joined Sulzer Bros. in Winterthur, Switzerland, in 1929 as a designer for double acting two-cycle engines. In 1936 he was named chief engineer in charge of design of Navy type engines for submarines and surface vessels. In 1949 he joined Nordberg as technical representative for Europe, establishing headquarters at Paris, France.

Grieshaber, also born in Switzerland, joined Usines Carels Freres in Ghent, Belguim in 1913 where he was active in experimentation and development of diesel engines. In 1915, he joined Nordberg and provided valuable technical assistance in the development of their early diesel engines. He was later appointed head of the Steam Engine and Compressor department and in 1936 was named chief engineer.

Ralph Miller, a native of Denmark, was first employed in the U. S. by the De LaVergne Machine Company, where he was assigned to assist W. T. Price in the development of the first American cold starting, solid injection engine. Engine design and development work followed with the Ingersoll Rand Company, Superior Engine Company, American Locomotive Company, and Worthington Corporation.

In 1945 Miller joined Nordberg as chief engineer of the Four-cycle Engine department. His major activity has been in the application of intercooled turbocharged engines and the development of Supairthermal engines using the Miller System of turbocharging under world-wide exclusive license.

GUNITE COATINGS for PIPE LINES

Reinforced GUNITE COATING being applied to pipe.

*Your inquiry solicited.*

GUNITE CONCRETE & CONST. CO.

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MINNEAPOLIS — NEW ORLEANS

NEW! Write for Bulletin.

Patented

PIPELINE VENTS AND MARKERS

FLEET-LINE CO.

P. O. BOX 276K

SHREVEPORT, LOUISIANA

MACHINIST

Pipe line department of major oil company has opening for a top notch machinist. Individual selected must be thoroughly experienced in operation and maintenance of diesel and electric motors, centrifugal pumps, and electrical controls. Past experience in supervisory capacity desirable. Write P. O. Box 7540-A, Chicago 80, Illinois, Attention Superintendent Industrial Relations.

## George L. Gore Transferred To Dowell Office in Denver

Dowell Incorporated has promoted George L. Gore to petroleum engineer and transferred him to the company's Rocky Mountain operations area with district offices at Denver.

George L. Gore

Gore's new duties will include supervising the technical phases of operations in Colorado, North Dakota, South Dakota, Montana, Wyoming, Utah and parts of New Mexico and Nebraska.

Gore joined Dowell in Great Bend, Kansas, in 1949 as a junior service engineer, shortly after his graduation from Oklahoma A&M College with a Bachelor of Science degree in electrical engineering. At Great Bend he received promotions to service engineer and development engineer.

He was transferred to Dowell's general offices in Tulsa as a development engineer in 1953 and in this capacity aided in the field applications of newly-developed Dowell oil well services.

## Ric-Wil Company Appoints Wood General Sales Manager

William F. Wood has been appointed general sales manager of Ric-Wil Company of Barberton, Ohio. He will replace C. W. Wheeler, who is retiring.

William F. Wood

Wood, formerly district manager in charge of the Washington, D. C. office, has been with Ric-Wil for 16 years.

A graduate of the University of Omaha, he is a member of the American Society of Heating and Ventilating Engineers and the Armed Forces Chemical Association.

## Consolidated Western Builds New Pipe Manufacturing Plant

Consolidated Western Steel division of United States Steel Corporation has announced it will construct a steel pipe manufacturing plant near the Geneva Works of U. S. Steel's Columbia-Geneva Steel division near Provo, Utah. Construction will begin this fall.

The plant will produce electric weld pipe used for transmitting natural gas, petroleum products and water, and will replace line pipe manufacturing facilities of Consolidated Western Plants at South San Francisco, Berkeley and Los Angeles.

## Allen B. Du Mont Laboratories Expands Sales Activities

The Mobile Communications department of Allen B. Du Mont Laboratories, Inc., has expanded its sales activities to cover the northeastern Oklahoma area with the appointment of C. S. Perreault of Bud Perreault Electronics, Inc., Tulsa, as its sales and service representative.


POSITIVE CORROSION PROTECTION

with HUMBLE

Protective Coatings

**NON-DRYING TYPE** — A wide range in consistency, from very thin to very thick. All afford excellent rust protection to steel surfaces, yet may be easily removed with any ordinary petroleum solvent.

**HARD-DRYING TYPE** — These coatings, when dry, form a thin hard uniform film over the surface. They are more than ordinary "paint" because they inhibit or prevent the growth of corrosion under the coating film.

Humble Protective Coatings include not only the well-known RUST-BANS but other special coatings which furnish protection for all kinds of surfaces under all kinds of uses.

HUMBLE

*Call on the Sales Technical Division of Humble Oil & Refining Co. for an analysis of your problem and expert advice. Written recommendations will be submitted without cost.

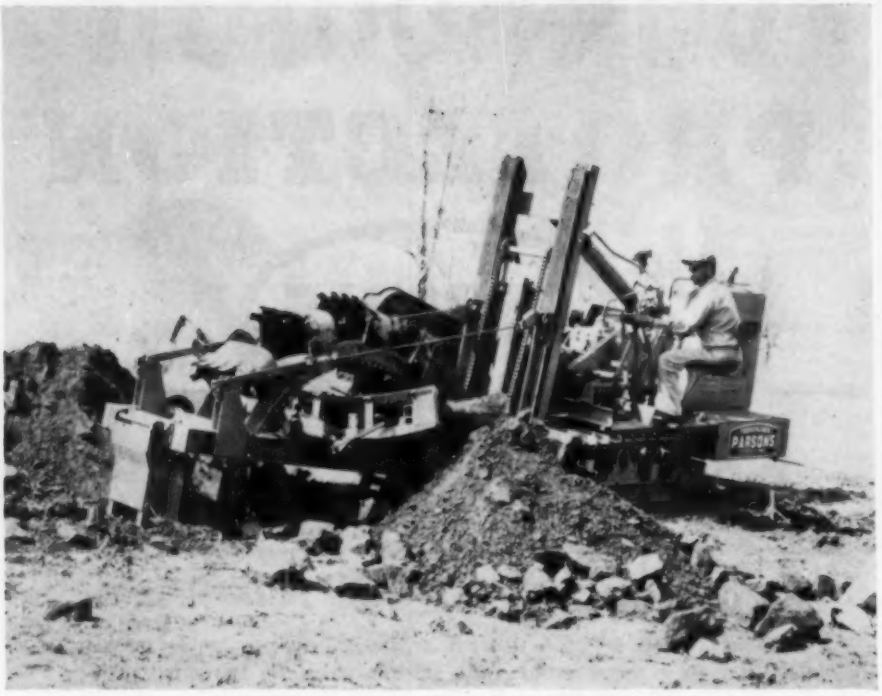
PROTECTIVE COATINGS

INCLUDING RUST-BAN

HUMBLE OIL & REFINING CO. • P. O. BOX 2180, HOUSTON, TEXAS

# What's New in Equipment

## for the Pipe Line Industry




### Digging Wheel Control

Hydraulic control of the digging wheel is an important feature on the new 150 wheel-type trenchliner developed by the Parsons Company of Newton, Iowa (a Koehring subsidiary). Digging wheel travels up and down a vertical mast. Hydraulic ram raises and lowers the wheel, holds close grade tolerance at any depth. Mast also is power controlled. A separate hydraulic ram tilts the mast to carry weight of the wheel forward on the machine for proper balance when traveling, loading or unloading on trucks or trailers.

This new trenchliner produces from 12 inches to 25 lineal feet of trench per minute. With a digging capacity of 5¾ feet deep and 16 to 26 inches wide, it meets requirements for drainage work, pipe line installations, irrigation projects, general utility and construction work. The Model 150 is equipped with a range of 30 digging feeds, and three speeds on the heavy-duty digging wheel up to 11.25 revolutions per minute.

Other features incorporated in the new 150 Trenchliner include: a shiftable and reversible belt conveyor that discharges spoil to either side; dual purpose, friction type clutch on digging wheel drive that acts as an automatic safety to protect machinery against shock loads; solid or tineback buckets with gumbo lips or exclusive "Tap-In"-type teeth; retractable bucket-cleaner; optional tile box and chute. Gasoline or diesel engine available. With three point suspension mounting, the weight of the 150 trenchliner is well distributed over the full crawler mounted tractive system. Bearing pressure is six or eight pounds psi, depending on the use of 16 or 12-inch lug type treads.

For more data, circle **No. E1** on Readers' Service Card, last page this issue.

### Motor Grader

Increased horsepower is one of the several improvements in the Caterpillar No. 12 motor grader. The improved No. 12 packs 115 horsepower. In addition the clutch and transmission have increased capacity to match the greater horsepower.

In both the cat No. 12 and No. 112, convenient one lever from-the-seat starting is now available. The No. 12 and No. 112 are also equipped with accelerator-decelerator pedals that permit changing speeds without changing the throttle setting. The new throttle is a free moving non-ratchet type and the instrument panel is located in the cab right of the operator for greater visibility.

For more data, circle **No. E2** on Readers' Service Card, last page this issue.

### Conduit Valve

A new type of large diameter conduit valve, manufactured by Darling Valve and Manufacturing Company in sizes eight inches and larger, offers an answer to the problems of pipe line service. Highly successful tests in the Texas fields have been completed.

Positive seal is accomplished by means of a special sealant developed for this service. Two reservoirs within the valve contain enough sealant for about 50 operations of the valve. When the valve is closed, line pressure forces the sealant into a channel on the downstream face of the seat. The only servicing required by these unique Darling-McEvoy valves is periodic recharging of the cylinders with sealant which, with pressure guns, takes only a few minutes. These valves incorporate the same principles which have been successfully used in McEvoy well-control and flow-line valves for many years.

For more data, circle **No. E3** on Readers' Service Card, last page this issue.

### Self-Priming Pump

Marine Products Company of Detroit is announcing the introduction of its all new Flomax 10 self-winding centrifugal pump. This new pump is rated with a maximum capacity of 10,980 gallons per hour. The unit is powered by a Wisconsin AKN engine and is mounted in a special protective carrying frame. The Flomax 10 which weighs only 151 pounds utilizes a new type of super-hard mechanical seal. The pump is designed to provide ready visual inspection, ample free working space, and protection to the engine from stray pumpage.

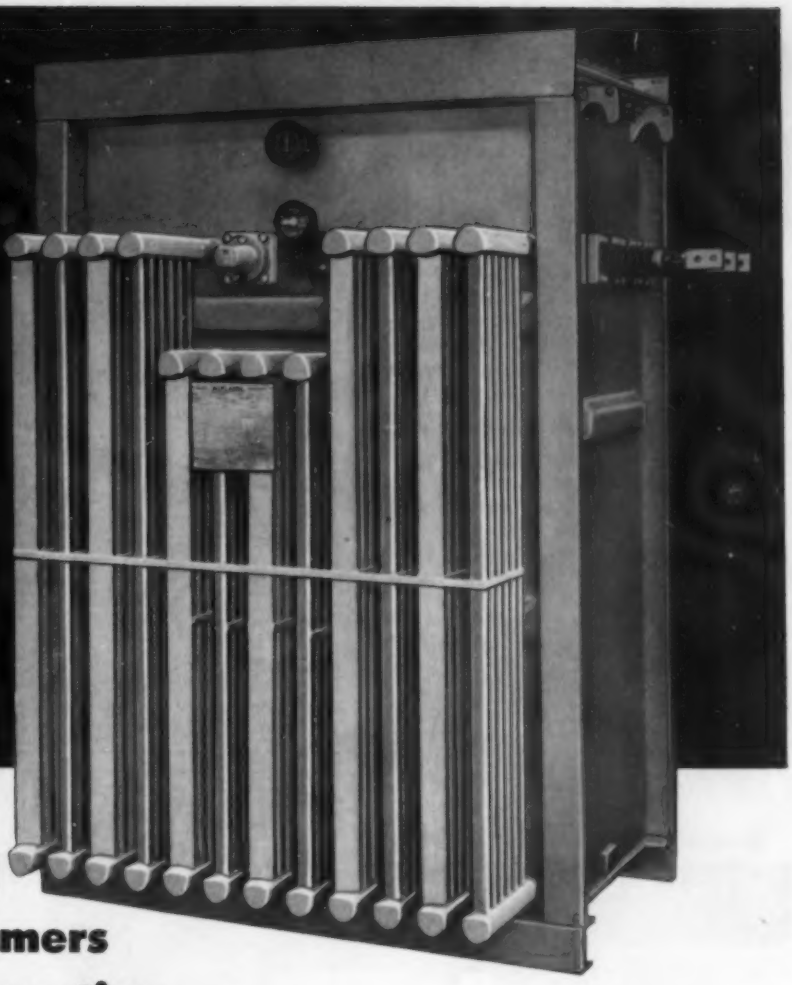
The Flomax 10 is availbale in cast-iron or all bronze construction.

For more data, circle **No. E4** on Readers' Service Card, last page this issue.

***Save time! Keep informed! Circle numbers on Readers' Service Cards, last page this issue.***

**Wagner®**
**TRANSFORMERS**
**... the choice of leaders in industry**

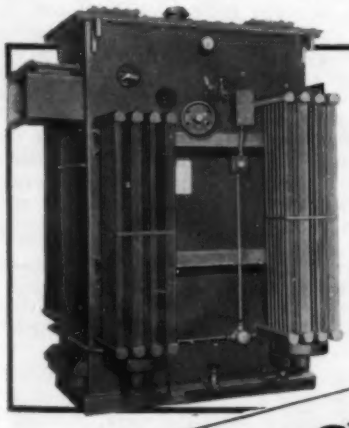
# first step to building a compact, modern Unit Substation



*THE NEW*

## Wagner Liquid-Filled Load Center Transformers designed for flush mounting

Now, Wagner Noflamol (non-inflammable liquid-filled) Load Center Transformers are available in a new, improved close-coupled design, as well as in the standard throat-connected design. These transformers can be flush-mounted with any make of switchgear to form a neat, compact, streamlined unit substation for modern industrial service.



**Wagner**
**Throat-Connected Unit Substation Transformers**

For outdoor installation, or for applications where it is desirable to locate the transformer away from the switchgear, Wagner can furnish these liquid-filled transformers in ratings to 2000 kva, 15 kv and below. Bulletin TU-13 gives full information.

Wagner close-coupled transformers are available in ratings from 500 through 2000 kva. They are carefully designed to meet your distribution requirements.

Look to Wagner for better transformers that assure a continuous, dependable flow of power. Your nearby Wagner engineer will be glad to help you solve your load-center problems. Call the nearest of our 32 branch offices, or write us.

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AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

T54-11

from TARAWA to TEXAS— OKINAWA to OKLAHOMA !

MP straight centrifugal pumps have always been demanded for tough, exacting jobs. On beach-heads and in oil fields, MP pumps have proven they can take it.

- All Bronze Corrosion Resistant Construction.
- Continuous operation—wet or dry.
- Belt Drive from any power source.
- Right hand, left hand, or reversible rotation.
- Slotted Base Mountings.
- Capacities to 280 gpm. • Pipe Sizes ¾" to 2".

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COOLING
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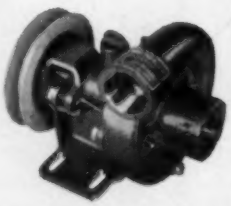

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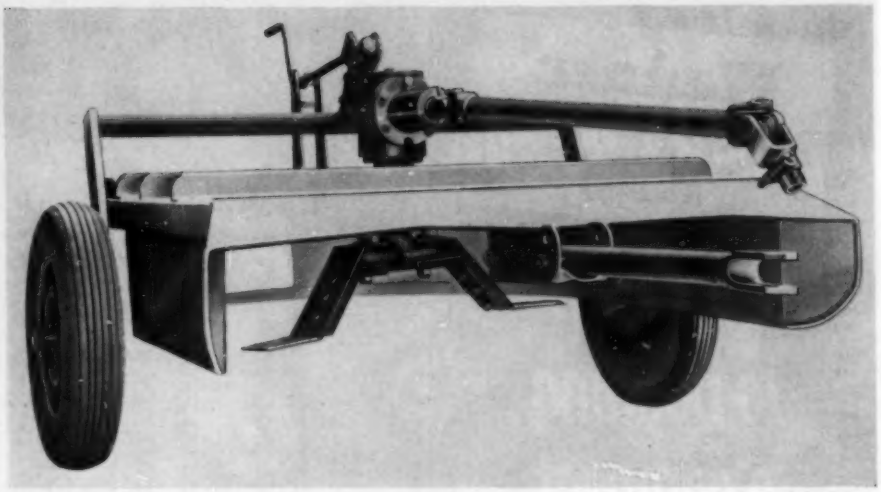
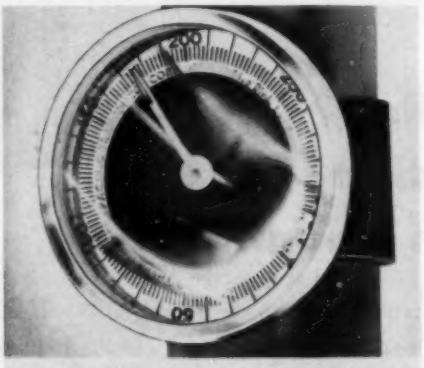
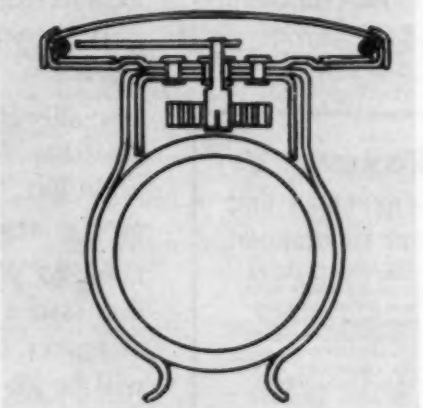


## Cutter

E. L. Caldwell & Sons of Corpus Christi, one of Texas pioneer manufacturers of brush cutting equipment, is now introducing its new S-2S cutter, its distinguishing feature being a swinging blade. The new implement is especially adaptable to the maintenance of oil and gas pipe line rights-of-way, a desirable characteristic being its ability to cut brush on rough, rocky or stumpy land. The Flexo blades will fold to a 90-degree angle, thus relieving pressure on the machine's gear assembly when fixed objects are encountered. The S-2S will cut a six-foot swath, and will handle brush two inches in diameter and better.

For more data, circle **No. E5** on Readers' Service Card, last page this issue.





## Pipe Surface Thermometers

The Pacific Transducer Corp., announces its new pipe surface thermometers to be used to obtain the temperature of pipes and tubes from one-half-inch to two inches in size. The thermometer is quickly fastened to the pipe by means of a spring clip without the use of any tools. The spring is merely pushed over the pipe by hand and snaps into place. The temperature sensitivity element is a calibrated bimetal and is closely coupled thermodynamically to the pipe. The accuracy is plus or minus 2° over the entire range of the thermometer, which reaches stability within five minutes. It is not necessary to open any pipe joints to install this thermometer. The bimetal element is protected by a copper cup which is made to fit the pipe closely.

The pipe surface thermometer comes in two ranges, one from —50° F to 250° F, and the other from 70° F to 370° F. The thermometer dial is two inches in diameter.

For more data circle **No. E6** on Readers' Service Card, last page this issue.

## Carfone Radio

Engineering Products Division, Radio Corporation of America has announced the development of the smallest commercial 10-watt two-way radio ever developed for mobile communications. Only 5½ inches high, 9¼ inches wide, and 17¾ inches long, the radio weighs but 40 pounds. The RCA carfone radio produces a minimum of 10 watts over the entire 148 to 175 megacycle band. It can be supplied for either narrow or standard band response and by simple re-arrangement of internal jumpers, can be converted quickly and without additions for either six or 12-volt battery operation.

Other design features include a single vibrator-selenium rectifier power supply, improved circuitry for increased sensitivity, and elimination of heretofore required external relay system.

Engineered for quick and easy maintenace, the new RCA carfone radio provides top-side tuning adjustments, minimum number of different tube types, and a novel internal color coding which identifies all elements of a given portion of the circuit. Test plugs, accessible through slide covers on the front panel, facilitate testing of the unit without need to remove the chasis.

For more data circle **No. E7** on Readers' Service Card, last page this issue.

***Save time! Keep informed! Circle numbers on Readers' Service Cards, last page this issue.***

# New Literature—

## Trench Hog

Arps Corporation has issued a brochure on the Blackhawk trench hog, showing how it can be used profitably in many jobs. It has a choice of three sizes of booms and cutters are furnished in widths of 6 inches through 20 inches. This bulletin shows the accessories for many different jobs such as the one side dirt delivery which is desirable when one side of trench must be clear of loose dirt for placement of welded pipe lines, gas mains, conduit, etc.; and the four-foot bulldozer furnished complete with a sub-frame, ram, hose and fittings. The dozer is lifted by means of the tractor hydraulic pump and eliminates the need for separate costly backfilling equipment. Specifications and photographs illustrating the materials, design, and application of the trench hog are included in the bulletin.

To get a copy, circle **No. E8** on Readers' Service Card, last page this issue.

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## Gas Turbines

A new publication explaining the application of gas turbines for gas pipe line pumping has been announced as available from the General Electric Company. The 12-page, two-color booklet, designated GEA-5962, contains detailed information on the operation and application of gas turbines for gas pipe lines. Numerous illustrations and drawings help explain turbine uses.

To get a copy, circle **No. E9** on Readers' Service Card, last page this issue.

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## Excavator

A new bulletin on the Model 255 ALC three-fourths-yard, long-crawler P & H excavator is now available from Harnischfeger Corporation, Small Excavator division. Printed in two colors, the four-page bulletin carries description and illustrations of the complete machine, as well as detailed information on the extra-long, wide crawlers.

To get a copy circle **No. E10** on Readers' Service Card, last page this issue.

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## Gages

Jerguson Gage and Valve Company has released a bulletin covering the three standard types of Jerguson convex scale and flat scale truscale remote reading gages, showing how these gages bring the liquid level down to where it can easily be seen, therefore protecting valuable equipment and preventing expensive shutdowns. Included are features of design and construction; description and schematics showing operation; schematics and charts graphically illustrating the three types of datum columns to meet specific needs; illustrations and descriptions of typical Truscale gage applications; and information on visible and audible alarms and Truscale repeaters.

To get a copy, circle **No. E11** on Readers' Service Card, last page this issue.

More than a mere pipe fitting!
catawissa
PERFECT SEAL
unions
give a 3 to 1
safety factor
PLUS
A PERFECT SEAL!
THERE'S A CATAWISSA PERFECT SEAL UNION FOR EVERY USE . . . ALL TEMPERATURES, ALL PRESSURES!
The full dependability of HOT FORGED STEEL is yours in a Catawissa Union (hot forged from solid steel bars) with several extra value features that are exclusive here at the UNION SPECIALISTS!
All Catawissa Unions are designed to give a 3-to-1 SAFETY FACTOR . . . 3,000-lb. service unions are tested to 9,000-lbs., 6,000-lb. service unions tested to 18,000-lbs., etc.
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Machining operations assure a UNIFORMITY AND ACCURACY heretofore found only in special fittings and, with rigid inspection both during and after machining, guarantees LEAKPROOF CONSTRUCTION!
Satisfaction is guaranteed in any application—whether it be general low pressure service or extremely high pressures and temperatures (for air, oil, gas, chemicals, hot oils, gases or steam).
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The Centrifugal Casting and "Heat Tensioning" methods used by France have proved: here are Piston Rings that assure you longer life and efficient oil control with no warping or loss of tension in service.

SPECIFY FRANCE POWER PISTON RINGS

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MAXIMUM SERVICE for you in our NEW PLANT

FRANCE PACKING COMPANY

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Why spend money hand-grubbing oil and gas line rights-of-way when you can do the job better, cheaper, quicker with a Caldwell S-2 Rotary Brush Cutter? The S-2's 57-inch reversible Spring Steel Blade will cut brush to two inches thick, and better, and will do it in a once-over. Users include Transcontinental, Texas Illinois Transmission, Tennessee Transmissions, others. We'll give you a demonstration. Write Dept. W.

**E. L. CALDWELL & SONS**
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## ERRATA

Professor R. L. Huntington of the University of Oklahoma has called attention to the article, "Two-phase Horizontal Flow" published in the October issue of PIPE LINE INDUSTRY. In Figure 5, the chart line should read "constant gas rates" rather than "constant liquid rates." Under "nomenclature" at the end of the article, the $g_c$—gravitational constant—should be $ft/hr^2$ instead of $ft/sec^2$.

Harry S. Keeling, author of "How to Save Steel Tanks," September, PIPE LINE INDUSTRY, is no longer with Southern Counties Gas Company, as stated, but is a consulting engineer with offices at 1718 Livonia Avenue, Los Angeles.

**Use Readers' Service Cards on opposite page for more information on products advertised in this issue.**

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new or old—riveted or welded

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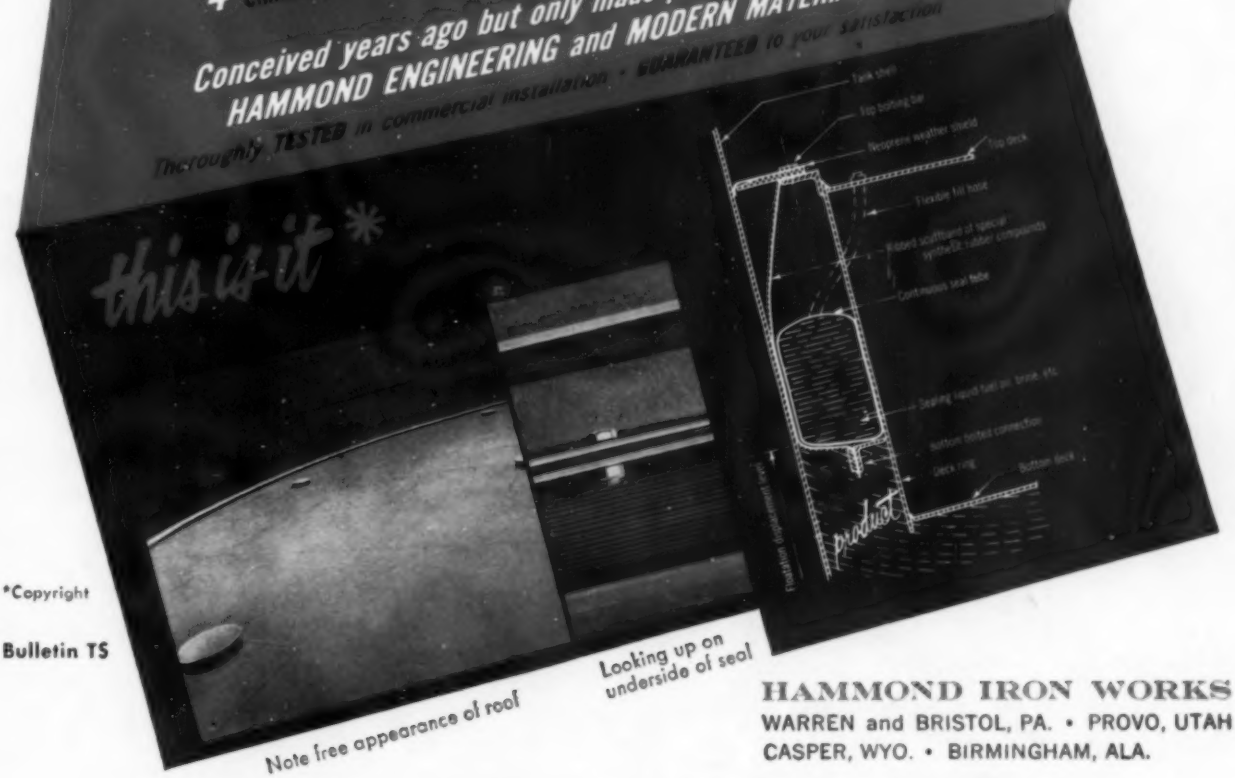


Note free appearance of roof

Looking up on underside of seal

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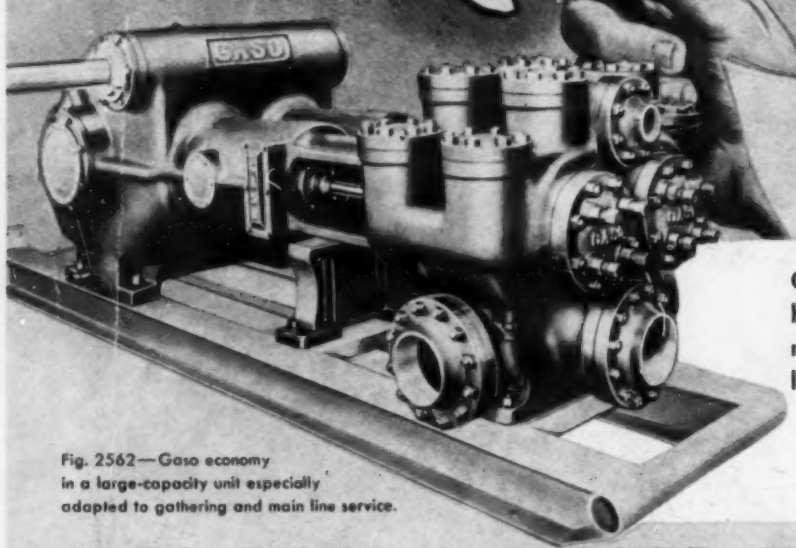


Fig. 2562—Gaso economy in a large-capacity unit especially adapted to gathering and main line service.

Gaso distributors, listed below, combine a first-hand knowledge of local conditions and requirements with a practical knowledge of the Gaso line. They are good people to know, helpful people to contact for a sound solution of any problem involving portable pumping units.

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